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# DIGITALIZED DONATION TOURISM: A CATALYST FOR RURAL RESILIENCE AND SUSTAINABLE DEVELOPMENT IN POST-WAR UKRAINE

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## Cyfrowa turystyka donacyjna: katalizator odporności obszarów wiejskich i zrównoważonego rozwoju w powojennej Ukrainie

### Streszczenie

W kontekście wojny na Ukrainie badanie odporności społeczności wiejskich staje się ważne. Niniejsze badanie analizuje rolę zrównoważonego marketingu w promowaniu zdygitalizowanej turystyki donacyjnej w celu wzmocnienia odporności obszarów wiejskich i zrównoważonego rozwoju w powojennej Ukrainie. Pomimo rosnącego potencjału dygitalizacji i turystyki opartej na donacjach, aspekty te pozostają niedostatecznie zbadane, szczególnie w regionach dotkniętych wojną. Niniejsze badanie ma na celu ocenę, w jaki sposób strategiczny marketing zdygitalizowanej turystyki donacyjnej może wpłynąć na odporność obszarów wiejskich w Ukrainie. Badanie wykorzystuje analizę klastrów i statystyczną ocenę wskaźników odporności społeczności wiejskich. Dane

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zbierano za pośrednictwem platform i aplikacji internetowych, a także analizy oprogramowania do zarządzania gościnnością ze strony internetowej Capterra. Badania wykazały korelację między poziomem dygitalizacji a odpornością społeczności wiejskich. Wdrożenie technologii cyfrowych zwiększyło aktywność gospodarczą o 20–25% i poprawiło spójność społeczną o 10%. Turystyka oparta na donacjach przyczyniła się do 30% wzrostu dochodów i wzmocniła lokalną gospodarkę. Wyniki potwierdzają, że dygitalizacja i turystyka oparta na darowiznach są kluczowymi czynnikami odporności społeczności wiejskich w czasie wojny. Zaleca się, aby inwestycje w infrastrukturę cyfrową i inicjatywy kierowane przez społeczność były priorytetem w celu zwiększenia odporności. Współpraca międzynarodowa jest również kluczowa we wspieraniu społeczności wiejskich w Ukrainie.

**Słowa kluczowe:** zrównoważony marketing, cyfrowa turystyka donacyjna, odporność obszarów wiejskich, rozwój pokonfliktowy, turystyka strategiczna.

## Abstract

In the context of the war in Ukraine, researching the resilience of rural communities becomes essential. This study examines the role of sustainable marketing in promoting digitalized donation tourism to bolster rural resilience and sustainable development in post-war Ukraine. Despite the growing potential of digitalization and donation-based tourism, these aspects remain underexplored, particularly in regions affected by war. This research aims to assess how the strategic marketing of digitalized donation tourism can influence the resilience of rural areas in Ukraine. The study employs cluster analysis and statistical evaluation of resilience indices of rural communities. Data was collected through online platforms and applications, and an analysis of hospitality management software from the Capterra website. The research demonstrated a correlation between the digitalization level and rural communities' resilience. Implementing digital technologies increased economic activity by 20-25% and enhanced social cohesion by 10%. Donation-based tourism contributed to a 30% increase in income and strengthened the local economy. The results confirm that digitalization and donation-based tourism are key factors in the resilience of rural communities during wartime. It is recommended that investment in digital infrastructure and community-led initiatives be prioritized to enhance resilience. International cooperation is also crucial in supporting rural communities in Ukraine.

**Keywords**: sustainable marketing, digitalized donation tourism, rural resilience, post-conflict development, strategic tourism.

## Introduction

The war in Ukraine has had a devastating impact on rural communities, causing significant disruptions to livelihoods and infrastructure. Traditional tourism models are no longer viable in many regions, necessitating innovative approaches to support rural economies and preserve cultural heritage. This study examines the role of strategic sustainable marketing in promoting digitalized donation tourism to bolster rural resilience and sustainable development in post-conflict Ukraine.

Despite the growing potential of digitalization and donation-based tourism, these aspects remain underexplored, particularly in regions affected by war. The

primary objective of this research is to assess how the strategic marketing of digitalized donation tourism can influence the resilience of rural areas in Ukraine during the military conflict.

The study employs a mixed-methods approach, combining qualitative and quantitative research techniques. In-depth interviews with tourism stakeholders, local communities, and potential donors were conducted to gather insights into the needs and preferences of various stakeholders. Additionally, a quantitative survey was administered to measure the potential impact of digitalized donation tourism on rural resilience and development.

The study's findings indicate that strategic sustainable marketing can be crucial in promoting digitalized donation tourism and enhancing rural resilience. By effectively communicating the benefits of digitalized donation tourism and leveraging digital platforms to connect tourists with reconstruction projects, it is possible to attract a significant number of socially conscious travelers willing to contribute to rural development.

## Literature review

### The conflicts impact rural tourism: economic and social restrictions on resources and services

Kesar (2022) examines how global crises, such as wars, impact the deglobalization of the tourism system. The study demonstrates that local economic resilience is crucial during crises, necessitating adapting local tourism services and resources. An example is tourism restructuring to support the local economy and minimize dependence on global supply chains. The study by Fontefrancesco et al. (2023) focuses on rural culinary tourism in Southern Europe, emphasizing the importance of education in this sector. The authors note that wars and crises can disrupt tourist flows, requiring local communities to adapt and seek new educational approaches to attract tourists and support the local economy. Maliuta et al. (2022) examine the development of rural areas in the EU through the potential of tourism. The authors emphasize that wars and conflicts can significantly degrade the attractiveness of regions for tourists, leading to economic losses and necessitating strategic recovery measures.

Tourism can be a tool for recovering rural areas if their natural and cultural potential is appropriately utilized. Ryglová et al. (2017) evaluate the quality of tourist destinations in rural areas. These authors highlight that wars and conflicts can deteriorate infrastructure and services, reducing the attractiveness of tourist locations. Infrastructure restoration and service quality improvement become key tasks for tourism recovery. Shcherbak et al. (2020) investigate using

key indicators for monitoring sustainable development in rural areas. The authors note that wars lead to the destruction of infrastructure and complicate access to resources, requiring careful monitoring and strategic planning for sustainable rural development. The study by Kolodiziev et al. (2024) indicates that military conflicts and crises significantly undermine rural tourism, causing a sharp decline in tourist arrivals and revenues, as observed in regions such as Kherson, Luhansk, and Donetsk, where tourism tax revenue dropped by 92%.

Literature analysis on this topic has proven that the economic consequences of war for rural areas manifest primarily in the deterioration of infrastructure and the reduction of tourist attractiveness of regions; economic losses due to the decline in tourist flows and the destruction of tourist sites; and the need for the restoration and adaptation of the local economy to new conditions. The social problems caused by war are evident in the decline in the quality of life of the local population due to infrastructure destruction and limited access to essential services, increased social tension, and migration of the population from rural areas to safer regions. The psychological impact of war on local residents, especially children and the elderly, manifests in restricted access to resources and services; the destruction of transport and utility infrastructure, limiting access to water, electricity, and medical services; difficulties in accessing educational and cultural resources, affecting the social and economic development of regions; and the necessity to coordinate efforts for recovery and ensure sustainable access to essential resources and services.

The analysis shows that the experience of other countries can help Ukraine develop strategies to enhance the resilience of rural areas in times of crisis and war. Digital technologies, educational programs, and strategic planning can contribute to the recovery and development of rural territories.

**The role of digital technology and sustainable practices in digitalized donation tourism**

The concept of digitalized donation tourism, which integrates digital technology with philanthropic efforts, is emerging as a promising approach to supporting rural resilience and development. This review examines recent scholarship on sustainable tourism marketing, focusing on the role of digital technology, transparency, and audience-centric strategies in promoting digitalized donation tourism.

Vila et al. (2024) highlight the growing influence of digital technology on tourist decision-making. Digital platforms can provide tourists with transparent information about destinations, sustainability practices, and opportunities to contribute to local communities. This aligns with the core premise of digitalized donation tourism, which leverages technology to connect potential donors with rural reconstruction projects.

Lulaj et al. (2024) examine the financial challenges tourism economies face during and after crises. Their research highlights the importance of innovative strategies to attract tourists and generate revenue, particularly in conflict-affected regions. Digitalized donation tourism, emphasizing transparent financial flows, can offer a viable solution for rural communities seeking to recover from the impacts of conflict.

The authors emphasize the importance of sustainability marketing in tourism research. They demonstrate how effectively communicating a destination's commitment to sustainability can attract tourists who prioritize responsible travel practices. This aligns with the goals of digitalized donation tourism, which aims to promote sustainable development and community empowerment.

The importance of place branding and cultural-historical mapping in tourism marketing is highlighted. By creating a compelling narrative that highlights unique cultural heritage and efforts to rebuild rural communities, digital charity tourism can attract tourists interested in supporting worthy causes.

Several of the above-mentioned publications explore tourism ambassadors' role in shaping a destination's image. By leveraging local community members as ambassadors, digitalized donation tourism can share authentic stories about the reconstruction process and the impact of donations, enhancing the destination's appeal to potential tourists.

This review of recent scholarship highlights the critical role of digital technology, sustainability marketing, and community engagement in promoting digitalized donation tourism. By effectively communicating the benefits of sustainable travel and the positive impact of donations, digitalized donation tourism can contribute to the recovery and development of rural communities in post-conflict Ukraine.

**Sustainable tourism marketing strategies and digitalized donation tourism in post-conflict Ukraine**

Janjua et al. (2022) highlight the importance of sustainable tourism marketing practices, especially in rural communities where homestays are pivotal in supporting local economies and preserving cultural heritage. The study reveals how sustainable marketing can support local initiatives and create new opportunities for digitalization and donation-based tourism during crises.

Gilmore et al. (2007) examine sustainable tourism marketing strategies at World Heritage sites. The article emphasizes the need for a transparent and responsible approach to marketing, which is directly relevant to integrating digital tools and donation-based tourism to enhance the resilience of rural regions. They investigate how different generations use social media for sustainable tourism marketing. This research provides valuable insights into how social plat-

forms can promote donation-based tourism and support sustainable practices in post-conflict regions.

Font & McCabe (2017) analyze the contexts, paradoxes, and approaches of sustainable tourism marketing. This research helps understand how digitalization and donation-based tourism can help overcome these paradoxes and create transparent communications to attract and inform tourists during crises.

Jamrozy (2007) describes a paradigm shift in tourism marketing towards sustainability, emphasizing the need to transition to more sustainable practices and approaches, which also supports the idea of integrating donation-based tourism and digitalization to achieve sustainable development in post-conflict Ukraine.

Walsh et al. (2017) consider the sense of place as a crucial component of sustainable tourism marketing. This understanding can help develop donation-based tourism that focuses on supporting local communities and preserving cultural heritage.

Pomering et al. (2011, 2010) present conceptual approaches to a contemporary marketing mix for digitalized donation tourism. The product is the actual experience of participating in rural reconstruction. The price is flexible, allowing tourists to choose their donation amount. The place is focused on Ukraine's unique cultural heritage and rural landscapes. Promotion relies on digital platforms and social media to attract potential donors and showcase the project's social and environmental benefits.

Kiráľová (2019) discusses sustainable tourism marketing strategies, including developing sustainable products and approaches to attracting conscious tourists. These strategies can serve as a foundation for creating effective digital and donation-based tourism models that contribute to the sustainable development of rural regions.

Carballo & León (2017) investigate the influence of artistically recreated nature on the image of tourist destinations. This research can help understand how elements of sustainability and culture can be integrated into the marketing of donation-based tourism.

These sources provide valuable insights and recommendations for developing effective digital and donation-based tourism strategies that contribute to sustainable development and enhance the resilience of rural regions in post-conflict Ukraine.

## Analysis of the problems and prospects of digitalization and donation-tourism in rural areas of Ukraine

The study by Bobek et al. (2023) focuses on the impact of the 2022 war in Ukraine on the travel habits of Ukrainian tourists. The authors note a significant change in tourist behavior caused by military actions. In the crisis, tourists have

become more oriented towards domestic tourism and digital platforms for trip planning, opening opportunities for developing digital solutions in rural tourism in Ukraine. This underscores the importance of adapting the tourism sector to new conditions and utilizing digital technologies to support local communities.

Kolodiziev et al. (2024) highlight the social consequences of conflicts for rural tourism, emphasizing enhanced security measures and adaptive marketing strategies to attract local tourists and support displaced populations. This includes developing differentiated pricing policies and special packages for donation-based tourism aimed at long-term stays.

Shcherbak et al. (2020) focus on using key indicators to monitor the sustainable development of rural areas. The authors emphasize the importance of digital tools for data collection and analysis, allowing for effective assessment of rural territories and informed decision-making. This is particularly crucial in crisis conditions, where rapid response to changes and coordinated recovery efforts are necessary.

Shcherbak et al. (2021) examine the use of a sharing platform to prevent new outbreaks of the COVID-19 pandemic in rural areas. The authors demonstrate how digital platforms can be used for resource and information sharing, supporting and developing rural communities. This is an example of the successful implementation of digital solutions that can be adapted to support rural tourism and donation campaigns in Ukraine.

The study by Shcherbak et al. (2024) is dedicated to the sustainable development of amalgamated territorial communities in the context of conflict. The authors analyze the challenges rural areas face and propose strategic measures to turn these challenges into opportunities.

Using digital technologies and donation campaigns is considered a key tool for supporting and restoring rural territories, contributing to their sustainable development. The analysis shows that the experience of other countries and the use of digital technologies can significantly enhance the resilience of Ukraine's rural territories in times of war and crisis.

**Digitalization as a tool to increase the sustainability of rural tourism**

Studies focusing on the role of digitalization and donation-based tourism in enhancing the resilience of rural areas during wartime demonstrate that the use of modern technologies and digital solutions plays a key role in maintaining and developing rural territories. Implementing artificial intelligence in rural tourism contributes to modernization and sustainable development (Gan, 2023). The use of innovative media technologies for integrating tourism development and rural areas supports their resilience and adaptation during crisis periods (Liao, 2023). Digital practices applied to rural art festivals sustain social connections

and cultural heritage during pandemics and crises. Cultural integration through tourism development improves rural communities' economic and social structure, enhancing their resilience.

The Markov prediction model optimizes supply and demand management in rural tourism, which is critical for the resilience of rural areas in wartime conditions (Xu, 2023). Regression methods are used to assess and improve rural red cultural tourism chains, contributing to their revival in crisis conditions (Yu, 2024).

A rural tourism development plan based on nonlinear differential equations allows for effective resource management and supports the resilience of rural communities during wartime (Zhang, 2023a). Digital transformation of tourism enterprises enhances their adaptation and resilience, ensuring business continuity and supporting economic development in crisis situations (Zhang, 2023b). Research by Alonso et al. (2024) shows that digitalization through online platforms increases the visibility and accessibility of rural tourism, contributing to the economic resilience of rural communities in crisis conditions.

Digital tools, including crowdsourced geospatial data, optimize business processes in tourism, which is especially important for enhancing resilience and adaptation during crises; these findings are applicable to rural tourism. Through a case study, Bhandari (2004) demonstrates that using online platforms for fundraising and supporting affected communities in Nepal shows how digital tools can mobilize resources and ensure the resilience of rural communities in crisis conditions.

**Using the experiences of other countries to build rural resilience in military conflicts**

The study by Blešić et al. (2014) shows that the positive perception of local residents towards tourism development in rural areas of Serbia contributes to the sustainable development of rural communities. Currie et al. (2004) analyze the negative impact of the war on tourism in Croatia and ways to restore the industry, emphasizing the importance of stabilizing and rebuilding tourists' trust. Đorđević et al. (2019) highlight the significance of integrating tourism into economy to enhance the resilience of rural areas when exploring rural tourism development prospects in Serbia. The research by Jian and Ren (2023) proposes strategies for integrating habitat improvement and rural tourism development in China using data analysis technologies, contributing to the sustainable development of rural areas. Król (2019) evaluates the marketing potential of rural tourism websites in Poland, emphasizing the importance of digital tools for promotion and attracting tourists. Melichová and Majstríková (2017) discuss the potential of rural tourism as a driver for developing rural municipalities in Slovakia, focusing on the need for developing tourism infrastructure and services.

Mihalic (1999) analyzes the decline and recovery of tourism in Slovenia after the war, highlighting the significance of marketing strategies and strengthening the international image. Moric (2013) identifies that clusters play a crucial role in enhancing the competitiveness of rural tourism in Montenegro, promoting local economies and tourism development. Neumeier and Pollermann (2014) argue that rural tourism can contribute to developing rural areas but has limitations, requiring consideration of local characteristics and needs. Nugraha et al. (2021) examine the importance of tourist destinations' quality and engagement in creating memorable experiences, particularly relevant to rural tourism. Radnic and Ivandic (1999) analyze the consequences of the war on tourism in Croatia and ways to restore the industry, emphasizing the importance of strategic planning and marketing. Shcherbak et al. (2021) demonstrate that using sharing platforms to prevent new outbreaks of the COVID-19 pandemic in rural areas can be a valuable experience for Ukraine. Stanovčić et al. (2018) analyze the role of rural tourism in developing rural areas in Montenegro, highlighting the importance of entrepreneurship and the integration of tourism into local economies. Šťastná et al. (2020) show that cultural tourism can drive developing rural areas in the Czech Republic, using wine tourism in Moravia as an example. Sutomo et al. (2024) analyze self-sufficiency within community-based rural tourism in Indonesia, emphasizing the importance of community involvement and self-governance. Trybuś-Borowiecka (2023) examines Polish tourist activity during the COVID-19 pandemic, emphasizing the importance of adaptation and flexibility in the tourism industry. Zwierzchowska (2008) analyzes tourism development in rural areas of Castilla-La Mancha, Spain, focusing on the importance of cultural and natural resources for attracting tourists. These studies underscore the importance of digital technologies and integrating tourism into economy to enhance the resilience of rural areas. The experiences of other countries can help Ukraine develop effective strategies to strengthen the resilience of rural communities in times of crisis and war.

The analysis of existing research on sustainable tourism and digital technologies demonstrates the growing role of these tools in developing rural regions. Studies by authors such as Janjua et al. (2022), Gilmore et al. (2007), and others emphasize the importance of transparent and responsible marketing in tourism, especially in preserving cultural heritage and supporting local communities. In the context of military conflict, where traditional sources of funding and development are limited, digitalization and donor tourism represent innovative approaches that can ensure the sustainability and development of rural areas.

**Hypothesis, objectives, and expected results of the study**

Based on this, the following hypothesis is put forward:

— In times of war, digitalization and donation tourism can significantly enhance the resilience of rural communities in Ukraine.

The rationale for the hypothesis:

— Digitalization enables the creation of effective platforms to attract donors and inform tourists about restoration projects.
— Donor tourism creates a direct link between tourists and local communities, stimulating financial support and the development of sustainable practices.

Combining these two factors makes it possible to overcome the limitations caused by the military conflict and create new opportunities for rural development.

This study aims to investigate the impact of digitalization on the resilience of rural communities during wartime, with a specific focus on the Ukrainian context. By examining how rural communities have leveraged digital technologies and tools to maintain economic activity, access information, and foster social connectivity during the conflict, this research seeks to identify critical factors influencing the successful implementation of digitalization and donation tourism strategies. The study will contribute to a deeper understanding of the relationship between digitalization, donation tourism, and rural resilience. The findings are expected to benefit the development of policies and strategies aimed at supporting rural communities in Ukraine and other conflict-affected regions. Additionally, the research will highlight the potential of digital technologies and donation-based tourism as tools for crisis response and recovery.

Objectives:

— to investigate the impact of digitalization on the resilience of rural communities during wartime,
— to analyze how access to digital technologies and tools can help rural communities maintain economic activity, access to information, and social connectivity during the war,
— to identify factors influencing the successful implementation of digitalization and donation tourism in wartime conditions.

Expected Results:

— The study will reveal the relationship between digitalization, donation tourism, and the resilience of rural communities during wartime.
— The findings will have practical value for developing and implementing policies aimed at supporting rural communities in Ukraine.
— The research may encourage the use of digital technologies and donation tourism to support the resilience of rural areas during crises.

The study was conducted in 2022-2023, based on a survey of rural tourism enterprises and united territorial communities in the Sumy region of Ukraine.

## Materials and Methods

### Methodology for assessing the impact of digitalization and donation tourism on the sustainability of rural areas in conflict conditions

Rural communities impacted by conflict encounter challenges that demand innovative technological solutions to maintain economic activity and social stability. This study presents a methodology to evaluate the impact of digital tools and donation tourism on rural resilience, employing an integrated approach that includes data standardization, multivariate analysis, clustering, and correlation analysis.

Key stages in the methodology:

Stage 1: Standardization of sustainability indicators. All sustainability indicators were standardized using the min-max method, following Janjua et al. (2022). This stage generated a dimensionless, standardized matrix and a reference matrix, enabling comparisons across dimensions.

Stage 2: Multivariate euclidean distance calculation. Euclidean distances were calculated to determine each community's proximity to an ideal reference, identifying variations in resilience relative to sustainability benchmarks.

Stage 3: Clustering analysis for classification of rural areas. K-means clustering was applied to classify rural areas based on sustainability levels, revealing patterns of resilience across different communities.

Stage 4: Correlation analysis of digitalization and sustainability indicators. A correlation analysis was conducted to assess the alignment between digitalization metrics (such as user engagement, economic impact, and tourist satisfaction) and sustainability indicators.

This methodology establishes a framework for evaluating rural resilience, supporting strategic planning, and guiding practical measures to enhance sustainability amid conflict (Table 1).

Table 1

*Methodology for assessing the impact of digitalization and donation-tourism on the sustainability of rural areas under war conditions*

| Calculation steps | Calculation algorithms | Interpretation of results | Scientific origin (Using similar algorithms) |
|---|---|---|---|
| Stage 1: Standardization of rural sustainability indicators | 1.1. Standardization of data for all sustainability components:<br>$z_{ij} = \frac{x_{ij} - \min(x_i)}{\max(x_i) - \min(x_i)}$,<br>where $x_{ij}$ — the value of the *j-th* indicator for the *i-th* sustainability component, max($x_i$) and min($x_i$) are the maximum and minimum values of the j-th indicator, respectively.<br>1.2. Compilation of the benchmark matrix:<br>$z^0 = [z_1^0, z_2^0, \dots z_n^0]$,<br>where *0* – the best value by columns.<br>1.3. Determining the multivariate Euclidean distance:<br>$d_i = \sqrt{\sum_{j=1}^{n}(z_{ij} - x_{0j})^2}$,<br>where $x_{0j}$ — the standardized value of the *j-th* indicator for the reference object, *n* is the number of indicators.<br>1.4. Average Euclidean distance:<br>$\bar{d} = \frac{1}{N}\sqrt{\sum_{j=1}^{N} d_i}$,<br>where N — the number of territorial communities.<br>1.5. Standard deviation of distances:<br>$s = \frac{1}{N}\sqrt{\sum_{j=1}^{N}(d_i - \bar{d})^2}$<br>1.6. Taxonomy coefficient for each component of rural sustainability:<br>$KT = 1 - \frac{d_i - \bar{d}}{s}$<br>where *KT* – one of the indicators of the components of rural sustainability. | Standardization is used to ensure comparability of data on different parameters, which may have different scales and units of measurement.<br>Bringing the original matrix of indicators to a dimensionless standardized form.<br>For each object, the distance to the reference object is calculated, where each indicator is maximized or minimized depending on the task.<br>Shows the average of the Euclidean distances from all objects to the reference.<br>It is used to estimate the spread of distances.<br>A measure of similarity between objects (UTCs) in a multidimensional space. It is calculated based on the distance of each object from the reference object, which is an ideal UTC. | Similar data standardization methods were used in Janjua et al. (2022) to analyze the sustainability of a social movement in Malaysia. |

Table 1
*Methodology for assessing…* (cont.)

| Calculation steps | Calculation algorithms | Interpretation of results | Scientific origin (Using similar algorithms) |
|---|---|---|---|
| Stage 2: Assessing the sustainability of rural territories | 2.1. Calculation of the integral index of social sustainability taxonomy (SS):<br>SS = 0.3 * HDI + 0.2 * PR + 0.2 * AEH + 0.3 * SC<br>2.2. Calculation of the integral index of the taxonomy of economic sustainability (EnS):<br>EnS = 0.3 * ED + 0.2 * UR + 0.3 * HI + 0.2 * FS<br>2.3. Calculation of the integral index of taxonomy of ecological sustainability (EcS):<br>EcS = 0.3 * EQ + 0.3 * NRU + 0.4 * CCR<br>2.4. Calculation of the integral index of taxonomy of institutional sustainability (IS):<br>IS = 0.3 * GE + 0.3 * RoL + 0.4 * CP,<br>where HDI — human development index; PR - poverty rate; AEH - access to education and health; SC - social cohesion; ED - economic diversification; UR - unemployment rate; HI - household income; FS - food security; EQ - environmental quality; NRU - natural resource use; CCR - climate change resilience; GE - governance effectiveness; RoL - rule of law; CP - citizen participation.<br>2.5. Index of sustainability of rural communities (ISRC):<br>$\mathrm{ISRC} = (0{,}3 \cdot \mathrm{SS}) + (0{,}3 \cdot \mathrm{EnS}) + (0{,}3 \cdot \mathrm{EcS}) + (0{,}3 \cdot \mathrm{IS})$,<br>where SS — social sustainability; EnS - economic sustainability; EcS - environmental sustainability; IS - institutional sustainability. | Very low sustainability level (0.00-0.20): Communities face significant challenges in social, economic, environmental and institutional dimensions.<br>Low resilience (0.21-0.40): Overall conditions are poor, but there are some areas for improvement.<br>Moderate level of resilience (0.41-0.60): Communities have a balance of strengths and weaknesses across all resilience indicators.<br>High level of resilience (0.61-0.80): Communities perform well in terms of overall sustainability with strengths in several dimensions.<br>Very High Resilience (0.81-1.00): These communities excel in all dimensions of sustainability, indicating a strong and resilient rural community. | Gilmore et al. (2007) used similar methods to create benchmarks in the context of sustainable tourism at World Heritage sites |
| Stage 3: Classification of RTAs according to the level of sustainability by the method of cluster analysis | 3.1. Selecting K initial cluster centers and assigning to clusters:<br>$\arg\min_k \|X_i - C_k\|^2$,<br>where $\|\cdot\|$ denotes the Euclidean distance.<br>3.2. Update of cluster centers:<br>$\mathrm{C}_k = \frac{1}{\lvert S_k \rvert} \sum_{X_i \in S_k} X_i$,<br>where $S_k$ — the set of points belonging to a cluster.<br>3.3. Steps 3.1 and 3.2 are repeated until the cluster centers no longer change or the changes are negligible, or the maximum number of iterations is reached. | At each iteration, each data point Xi is assigned to a cluster whose center Ck is the closest to the given point.<br>After assigning all points to clusters, the cluster centers are recalculated so that they are the center of mass of all points in a given cluster.<br>The algorithm stops when changes in the positions of cluster centers between iterations become below a predefined threshold, or when a predefined number of iterations has been reached. | Gilmore et al. (2007) used cluster analysis to group tourism regions according to sustainability levels |

Table 1
*Methodology for assessing…* (cont.)

| Calculation steps | Calculation algorithms | Interpretation of results | Scientific origin (Using similar algorithms) |
|---|---|---|---|
| Stage 4: Assessing the impact of online platforms and applications of rural and subsistence tourism on the level of sustainability of rural territories | 4.1. Evaluating the use of online platforms and rural tourism applications.<br>4.1.1. Conversion rate: CR = (P/U) * 100%,<br>where P – purchases, U – users<br>4.1.2. Average order value: AOV = R/P,<br>where R – revenue<br>4.1.3. Return on investment: ROI = ((Pr - I) / I) * 100%<br>where Pr – profit, I – investment<br>4.1.4. Customer satisfaction rate: CSR = (PRp / TR) * 100%,<br>where PRp – positive reviews of the platform, TR – total reviews<br>4.2. Evaluation of the use of domestic tourism in rural areas.<br>4.2.1. Average check: AC= DF/NT,<br>where DF – donation funds, NT – number of tourists<br>4.2.2. Economic impact: EI= CDT/GDP,<br>where CDT – contribution of donation tourism to GDP, GDP – regional GDP<br>4.2.3. Participation level: PL= PTDT / NT,<br>where PTDT – number of tourists participating in donation tourism programs<br>4.2.4. Tourist satisfaction: TS= PRdt / TR,<br>where PRdt – positive feedback on donation tourism, TR – Total Number of Reviews<br>4.3. Conducting correlation analysis to identify the relationship between the performance indicators of platforms, donation tourism and indicators of sustainability of rural areas. | Using statistical methods to determine the degree of correlation between CR, AOV, ROI, CSR, AC, EI, PL, TS and indicators of social, economic, environmental and institutional sustainability (SS, EnS, EcS, IS).<br>Positive correlation between economic indicators (CR, AOV, ROI, AC, EI) and economic sustainability (EnS).<br>Positive correlation between satisfaction and participation indicators (CSR, TS, PL) and social sustainability (SS).<br>Positive impact of indicators of all categories on the overall index of rural sustainability (ISRC). | Kiráľová (2019) used correlation analysis to investigate the impact of digitalization on tourism sustainability |

Source: author's methodology

## Data for assessing rural resilience in wartime

To evaluate rural resilience, indicators were selected to represent social, economic, environmental, and institutional sustainability (Table 2).

Table 2
*Indicators for assessing the sustainability of rural areas*

| Sustainability Component | Indicator | Description | Source |
|---|---|---|---|
| **Social Sustainability** | Human Development Index (HDI) | A composite index measuring social well-being, developed by UNDP. | Canton (2021) |
| | Poverty Rate | Reflects economic inequality, a standard metric in social sciences. | Luebker (2014) |
| | Access to Education and Healthcare | Key determinants of human capital, aligned with SDGs on quality education and good health. | Anderson et al. (2021); Robert et al. (2005) |
| | Social Cohesion | Measured by trust in institutions and civic engagement, critical for community resilience. | Andrews et al. (2014) |
| **Economic Sustainability** | Economic Diversification | A strategy for reducing economic vulnerability, important in regional economics. | Hvidt (2013) |
| | Unemployment Rate | Standard labor market indicator providing insights into economic health. | Chen (2008) |
| | Average Household Income | Fundamental measure of economic well-being. | Kansiime et al. (2021) |
| | Food Security | Essential for overall well-being and economic stability, as defined by the UN's Committee on World Food Security. | Pinstrup-Andersen (2009) |
| **Environmental Sustainability** | Environmental Quality | Includes air and water quality, and biodiversity, crucial for human health and ecosystem services. | Omri et al. (2015) |
| | Natural Resource Utilization | Measured by consumption patterns, essential for sustainable development. | Liu et al. (2023) |
| | Climate Change Resilience | Vital for adapting to future challenges, as defined by the IPCC. | Morecroft et al. (2012) |
| **Institutional Sustainability** | Governance Effectiveness | Measured by corruption, transparency, and government efficiency, crucial for sustainable development. | Brezzi et al. (2021) |
| | Rule of Law | Encompasses the protection of rights and enforcement of laws, the cornerstone of stable societies. | Rosenfeld (2001) |
| | Citizen Participation | Essential for democratic governance and social cohesion. | Brezzi et al. (2021) |

Each sustainability component consists of specific indicators:

Social Sustainability is measured using the Human Development Index (HDI), poverty rate, access to education and healthcare, and social cohesion. The HDI,

developed by UNDP, serves as a comprehensive measure of social well-being (Canton, 2021). The poverty rate reflects economic inequality, a standard metric in social sciences (Luebker, 2014). Access to education and healthcare, key determinants of human capital, aligns with SDGs on quality education, good health, and well-being (Anderson et al., 2021; Robert et al., 2005). Social cohesion, measured by trust in institutions and civic engagement, is essential for community resilience (Andrews et al., 2014).

Economic Sustainability is assessed using economic diversification, unemployment rate, average household income, and food security. Economic diversification, an approach to reducing economic vulnerability, is a key concept in regional economics (Hvidt, 2013). The unemployment rate provides insight into economic health (Chen, 2008), while average household income is a fundamental measure of economic well-being (Kansiime et al., 2021). Food security, crucial for overall stability, is defined by the UN's Committee on World Food Security (Pinstrup-Andersen, 2009).

Environmental sustainability is evaluated through indicators such as environmental quality, natural resource utilization, and climate change resilience. Environmental quality, encompassing air and water quality as well as biodiversity, is critical for human health and ecosystem services (Omri et al., 2015). Natural resource utilization, based on consumption patterns, is essential for sustainable development (Liu et al., 2023). Climate change resilience, defined by the IPCC, is vital for adapting to future challenges (Morecroft et al., 2012).

Institutional Sustainability uses indicators of governance effectiveness, rule of law, and citizen participation. Governance effectiveness, measured by factors such as corruption, transparency, and government efficiency, is essential for sustainable development (Brezzi et al., 2021). The rule of law, encompassing rights protection and law enforcement, is the foundation of stable societies (Rosenfeld, 2001). Citizen participation in decision-making is critical for democratic governance and social cohesion (Brezzi et al., 2021).

These indicators collectively provide a framework for assessing rural resilience in our study.The data was sourced from the 2023 statistical yearbooks of the State Statistics Committee of Ukraine, population surveys conducted in 2023, and open-source databases. Data processing was conducted using SPSS Statistics 23, applying descriptive statistics, correlation, and regression analyses. Correlation analysis assessed the relationships between resilience indicators and digitalization, while regression analysis identified significant factors impacting rural resilience levels.

The data for assessing the resilience of 26 amalgamated territorial communities in Sumy region, Ukraine, in 2023, is presented in Appendix A. The choice of the Sumy region of Ukraine as the study area is scientifically justified by several factors that make it particularly representative for examining rural resili-

ence in the context of armed conflict. First, its geographic location and exposure to military actions as a border region with the Russian Federation have subjected Sumy to significant conflict-related impacts since the onset of the full-scale invasion, providing a unique basis for analyzing the direct effects of war on rural communities. Second, Sumy is one of Ukraine's most characteristic border regions, making it a valuable case for identifying shared challenges and trends across similar areas facing military threats. Lastly, the availability of open data on the websites of local consolidated communities and the Sumy Regional Statistics Office (https://sumy.ukrstat.gov.ua/?menu=18) enabled the collection of the essential data required for a comprehensive analysis, ensuring a timely and accurate depiction of rural conditions in the region.

## Results and discussion

### Assessment of the current state of use of online travel platforms and applications

Online tour booking systems allow users to search, compare, book, and manage various travel services such as airline tickets, hotel reservations, car rentals, and activities. These systems help users to compare and book travel services from different suppliers.

The main features of online travel booking platforms are the user-friendly interface for searching and booking travel services; secure online booking and payment processing; real-time availability and pricing information; itinerary and booking management tools; customer support and traveler assistance; reporting and analytical capabilities.

There are the following types of online travel booking platforms:

— B2B systems that target travel agencies, tour operators, and travel management companies,
— B2C systems that are aimed at customers looking for vacation deals.

The most popular online travel platforms and applications are presented in Table 3.

Although some B2C platforms, such as Airbnb, offer options for rural tourism, they are not specifically designed for this niche market. According to Roman et al. (2024), travelers may find it challenging to discover an authentic rural tourism experience through these platforms. B2B platforms offer a more targeted approach to the rural tourism business, but they may not be familiar to all travel agencies and tour operators. There is a growing need for specialized online travel booking platforms specifically oriented towards the rural tourism market. These platforms could offer features such as detailed filtering options for rural

tourism experiences (e.g., type of farm, activities offered, location), educational resources on rural tourism, direct booking capabilities for rural tourism tours and events, and marketing tools for rural tourism businesses. Table 4 presents a comparison of the strengths and weaknesses of B2C and B2B platforms for booking rural tourism.

Table 3
*Examples of popular online travel platforms and apps for B2B and B2C*

| Platform | Key Features | Rating |
|---|---|---|
| TravelPerk | Self-booking, reporting, policy compliance, VAT refunds, 24/7 support | G2: 4.5/5, Capterra: 4.8/5 |
| SAP Concur | Automated expense reports, self-booking, real-time alerts and reminders | G2: 4/5, Capterra: 4.3/5 |
| Skyscanner | Flight search, search filters, multi-city itineraries | Trustpilot: 4.4/5 |
| Booking.com | Search and compare accommodation options, guest reviews, flexible booking conditions | Trustpilot: 1.2/5 |
| Rental Cars | Car rental comparison and booking, multilingual customer support | Trustpilot: 2.9/5 |

Source: https://www.travelperk.com/blog/best-online-travel-booking-systems/

Table 4
*Analyzing the feasibility of online platforms and applications for rural tourism*

| Feature | B2C platforms | B2B platforms |
|---|---|---|
| Focus | Aimed at individual travelers looking for agritourism experiences | Need for additional information from travel agencies and tour operators offering rural tourism services |
| Examples | Airbnb (limited rural tourism options)<br>Booking.com (limited filtering for rural tourism)<br>Hostelworld (may include some rural tourism options) | Ezus<br>Travelport<br>SiteMinder |
| Strengths | Large user base<br>User-friendly interface<br>Wide range of travel options | Optimized workflows<br>Integration with existing travel booking systems<br>Access to a network of travel professionals |
| Disadvantages | Limited focus on rural tourism<br>May not cater to the specific needs of agritourists<br>(e.g., farm activities)<br>Difficulty filtering for authentic rural tourism experiences | Not all rural tourism providers are familiar with B2B platforms<br>Limited marketing reach for smaller rural tourism businesses |

Source: https://uk.pcmag.com/travel-how-to/140987/the-best-travel-apps-for-2022

Online tour booking systems greatly simplify the process of organizing trips by providing users with a wide range of choices and convenient booking tools. Their use is particularly useful for rural tourism, where access to information and booking options may be limited.

**Assessment of the current state of donation tourism utilization.**

In recent years, one of the growing areas of tourism has been volunteer tourism (sometimes called voluntourism). This type of tourism involves traveling with the aim of participating in charitable and community projects. Despite the positive intentions, volunteer tourism can have both positive and negative impact on host communities. The level of volunteering has declined from 5.8 percent in 2012 to 4.2 percent in 2022. Over the decade, the rates decreased for both men and women, although the share of female volunteers increased from 4.1 percent in 2021 to 5.1 percent in 2022. These data are taken from the American Time Use Survey as of April 24, 2024. In 2022, more than 11 million people engaged in volunteer activities on an average day. Worldwide, the most popular volunteer activities are aimed at combating hunger and homelessness, as well as supporting health and well-being. Most volunteers are involved with religious, social, and educational organizations. At the same time, virtual volunteering and online platforms have become key tools for continuing volunteer activities during the pandemic (Figure 1).

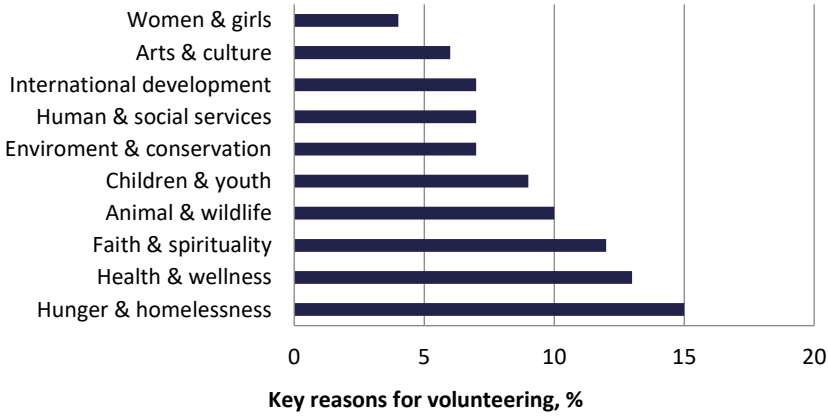


*Figure 1*
Key reasons for volunteering
Source: https://guides.loc.gov/tourism-and-travel/voluntourism

Figure 1 highlights the importance of volunteering and underscores its role in supporting and developing social initiatives, especially in the context of online

tourism platforms and donation-based tourism, which can significantly contribute to the sustainable development of rural areas. However, volunteer tourism can have negative consequences for the communities themselves. Short-term volunteers may lack cultural understanding and language skills, making it difficult to communicate and form meaningful relationships with community members. This can lead to feelings of isolation and distrust between volunteers and locals. Additionally, the use of resources such as drinking water, energy, and food, which could have been used by the local population, becomes an additional burden (Hernandez-Maskivker et al., 2018).

Figure 2 shows the top ten countries ranked by the share of the population engaged in charitable activities from 2009 to 2018. Sri Lanka leads the list, with 46 percent of the population participating in charitable activities.

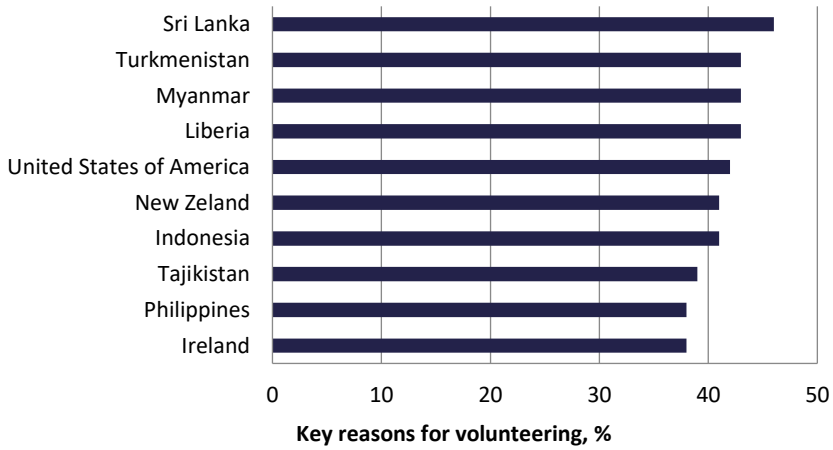


*Figure 2*
Top 10 countries by the amount of time volunteers spend on charity work (2012-2022) by population share
Source: https://tourismteacher.com/positive-impacts-volunteer-tourism/

Volunteer tourism is a complex phenomenon with many aspects to consider when designing and implementing programs. It is important to remember that achieving positive results requires careful preparation and respect for the cultural and social specificities of the host communities.

## Classification of UTCs of the Sumy region of Ukraine by sustainability zones by cluster analysis method

Estimated data on the assessment of the use of online platforms for rural tourism and donation-tourism in the Sumy region of Ukraine in 2023 are given in Appendix B.

The results of the calculation of sustainability indices of rural areas of the Sumy region of Ukraine are presented in Appendix C. Let us build a graph of K-means using these results of the sustainability assessment of rural areas of the Sumy region of Ukraine 2023 (Figure 3).

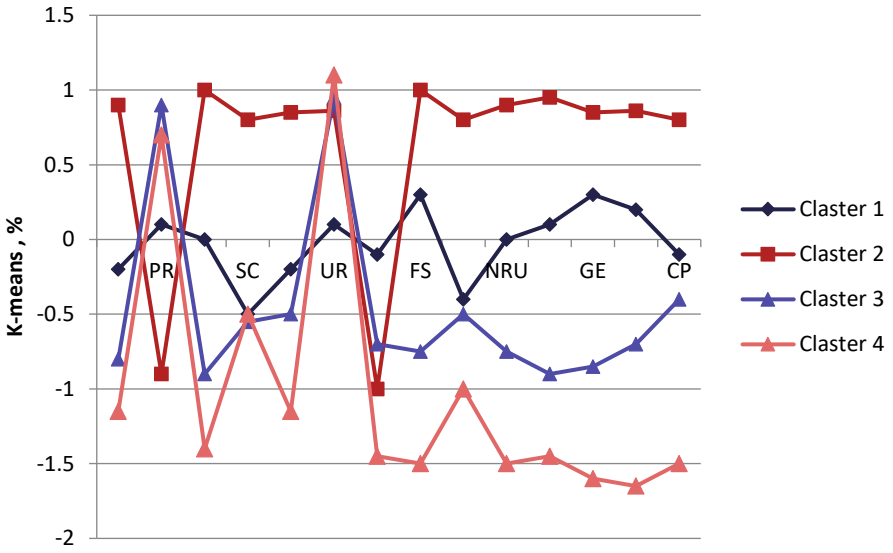


*Figure 3*
Graph of K-means sustainability indicators of UTCs of the Sumy region of Ukraine 2023
Source: STATISTICA 10 listing of cluster analysis

The cluster analysis of the united territorial communities (UTCs) of the Sumy region of Ukraine, presented in Figure 3, showed that the nine UTCs categorized in the first cluster demonstrate high overall sustainability and strong performance in various dimensions of sustainability. These UTCs are characterized by high social resilience, which includes developed human capital, low poverty, access to services, and strong social cohesion.

They are also strong economically, with diversified economies, low unemployment, and good household incomes. The environmental resilience of these communities is evident in their high environmental quality, sustainable resource use, and ability to adapt to climate change. Institutional resilience is evidenced by good governance, strong rule of law, and active citizen participation. Table 5 provides detailed data to support these findings.

The second cluster includes 11 united territorial communities (UTGs) of the Sumy region of Ukraine, located in the first quadrant, which indicates a high level of sustainability (0.81-1.00). These LSGs demonstrate outstanding performance in all aspects of sustainability: social, economic, environmental, and in-

stitutional. High social sustainability is manifested by developed human capital, low poverty, wide access to services, and strong social cohesion.

Table 5
*UTCs of the first cluster*

| **Members of Cluster Number 1 (Data_nor) and Distances from Respective Cluster Center - Cluster contains 9 cases** | | | |
|---|---|---|---|
| Case No. | Distance | Case No. | Distance |
| UTC1 | 0.4195182 | UTC15 | 0.9211511 |
| UTC4 | 0.3858447 | UTC19 | 0.3221205 |
| UTC10 | 0.7354566 | UTC22 | 0.3509002 |
| UTC12 | 1.106771 | UTC28 | 0.2990765 |
| UTC14 | 1.16254 | | |

Where UTC1 - Andriyashivska UTC, UTC4 - Boromlyanska UTC, UTC10 - Druzhbivska UTC, UTC12 - Znob-Novhorodska UTC, UTC14 - Komyshanska UTC, UTC15 - Korovynska UTC, UTC19 - Mykolayivska UTC, UTC22 - Nyzhniosyrovatska UTC, UTC28 - Chupakhivska UTC.

Economic resilience is characterized by a diversified economy, low unemployment, and high household incomes. Environmental sustainability includes high environmental quality and sustainable resource use. Institutional resilience is ensured by good governance, the rule of law, and active civic participation. The data presented in Table 6 supports these findings, indicating a strong and resilient rural community.

Table 6
*UTCs of the second cluster*

| **Members of Cluster Number 2 (Data_nor) and Distances from Respective Cluster Center - Cluster contains 11 cases** | | | |
|---|---|---|---|
| Case No. | Distance | Case No. | Distance |
| UTC3 | 0.09585428 | UTC20 | 0.1084219 |
| UTC6 | 0.6309888 | UTC23 | 0.4472633 |
| UTC8 | 0.3617064 | UTC24 | 0.09082834 |
| UTC9 | 1.150158 | UTC26 | 0.4039921 |
| UTC16 | 0.3792412 | UTC29 | 0.1097255 |
| UTC18 | 0.407508 | | |

Where UTC3 - Berezivska UTC, UTC6 - Burynska UTC, UTC8 - Vilshanska UTC, UTC9 - Hrunska UTC, UTC16 - Krasnopilska UTC, UTC18 - Mykolaivska (Bilopilskyi district) UTC, UTC20 - Myropilska UTC, UTC23 - Novoslobidska UTC, UTC24 - Stepanivska UTC, UTC26 - Khotynska UTC, UTC29 - Shalyhinska UTC.

Table 6 presents the six united territorial communities of the third cluster, located in the third quadrant. These communities are characterized by balanced strengths and weaknesses across all sustainability indicators.

Table 7
*UTCs of the third cluster*

| **Members of Cluster Number 3 (Data_nor) and Distances from Respective Cluster Center - Cluster contains 6 cases** | | | |
|---|---|---|---|
| Case No. | Distance | Case No. | Distance |
| UTC7 | 0.255842 | UTC21 | 0.2568442 |
| UTC11 | 0.8679449 | UTC25 | 0.2251384 |
| UTC17 | 0.2286967 | UTC27 | 0.240862 |

Where UTC7 - Verkhniosyrovatska UTC, UTC11 - Dubovyazivska UTC, UTC17 - Krolevetska UTC, UTC21 - Nedryhailivska UTC, UTC25 - Trostianetska UTC, UTC27 - Chernechchynska UTC.

Social indicators reflect a balance between strengths and weaknesses, as demonstrated by moderate levels of human capital development, average levels of poverty and access to services, and social cohesion. Economic indicators show strengths and weaknesses, including the diversity of economic activity and varying unemployment as well as household income levels.

Environmental indicators are also balanced, with moderate environmental quality and sustainability in using natural resources. Institutional indicators indicate a balance between good governance and the presence of areas for improvement, including the rule of law and civic participation. These data suggest the need for targeted strategies to strengthen the resilience of these communities.

The fourth cluster includes four united territorial communities located in the fourth quadrant. Overall, conditions in these communities are characterized by low scores in all aspects of sustainability, but some areas require and have potential for improvement. Social conditions remain difficult, with significant challenges, despite observed improvements in some aspects.

Economic indicators show significant challenges and indicate opportunities for development and improvement in selected areas. Environmental conditions are poor, but progress can be made in some areas. Institutional conditions are weak, although there are some positive developments.

Thus, improving the resilience of these communities requires a targeted approach to address the identified problems and realize potential improvements (Table 8).

As part of the study, we will build a matrix to assess the impact of donation tourism and the use of online tourism platforms and applications on the sustainability of rural areas of the Sumy region. The matrix includes social, economic, envi-

ronmental, and institutional sustainability components, which will allow us to systematically analyze various aspects of local community development (Figure 4).

Table 8
*UTCs of the fourth cluster*

| **Members of Cluster Number 4 (Data_nor) and Distances from Respective Cluster Center - Cluster contains 4 cases** | | | |
|---|---|---|---|
| Case No. | Distance | Case No. | Distance |
| UTC2 | 0.3879329 | UTC13 | 0.7946171 |
| UTC5 | 0.7190923 | UTC30 | 0.4273764 |

Where UTC2 - Bilopilska UTC, UTC5 - Bochechkivska UTC, UTC13 - Kyrykivska UTC, UTC30 - Shostka UTC

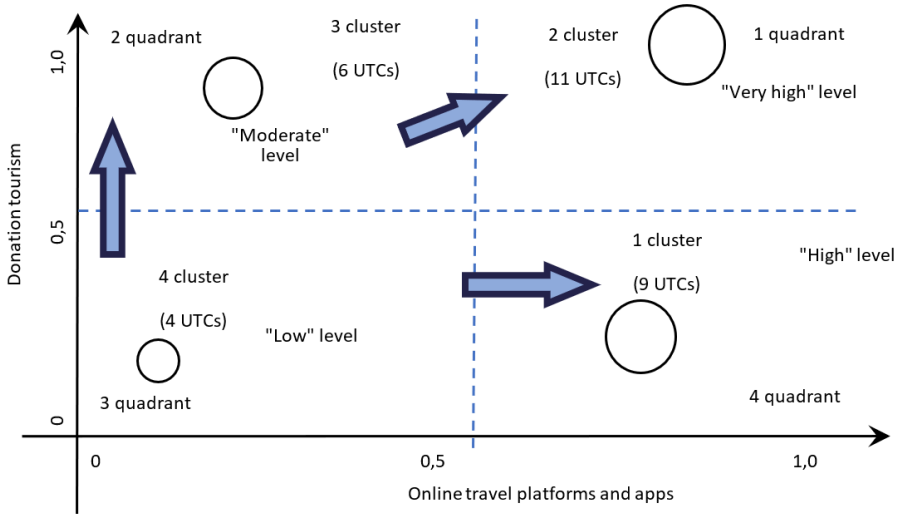


*Figure 4*
Matrix for assessing the impact of donation tourism and the use of online tourism platforms and applications on the sustainability of rural areas of Sumy region

The main objectives of the matrix include identifying the strengths and weaknesses of current conditions, identifying areas for improvement, assessing the contribution of digital tourism solutions, and donating tourism to the region's sustainability.

Expected outcomes of the matrix include determining the effectiveness of adopting online tourism platforms, assessing the extent of donation-tourism's impact on local communities' sustainability, and developing recommendations for improving sustainability performance.

Thus, this matrix will become an important tool for strategic planning and decision-making aimed at strengthening the sustainability of rural areas of the Sumy region.

**Correlation analysis of the relationship between the sustainability of rural areas and the effectiveness of the use of online platforms, applications, and subsistence tourism**

The hypothesis of the study, i.e. "Under wartime conditions, digitalization and pre-national tourism can play a significant role in increasing the resilience of rural communities in Ukraine" was confirmed using correlation analysis (Table 9).

Table 9
*Results of correlation analysis*

| **N=30** | **Regression Summary for Dependent Variable: CR (Data_cor_nor) R= 0.80130778 R?= 0.64209417 Adjusted R?= 0.62931181 F(1.28)=50.233 p<0.00000 Std.Error of estimate: 0.60884** | | | | |
|---|---|---|---|---|---|
| | b* | Std.Err. | b | Std.Err. | t(28) |
| **Intercept** | | | -0.000000 | 0.111159 | -0.000000 |
| **ISRC** | 0.801308 | 0.113059 | 0.801308 | 0.113059 | 7.087515 |

Source: STATISTICA 10 listing

The interpretation of the correlation analysis results is as follows. The strength of the correlation is indicated by the multiple correlation coefficient (Multiple R) = 0.801. A value of 0.801 suggests a strong positive correlation between the dependent variable CR and the independent variables included in the regression model. This value is close to 1, indicating a high degree of linear relationship. The model's explanatory power is illustrated by the coefficient of determination ($R^2$) = 0.642. This coefficient shows that 64.2% of the variation in the dependent variable CR is explained by the variation in the independent variables included in the model. The adjusted coefficient of determination (Adjusted $R^2$ = 0.629) also indicates a high explanatory power of the model, considering the number of predictors. The statistical significance of the model is explained by the F-statistic = 50.23287 and p-value < 0.000001. The high F-statistic value and the extremely low p-value indicate that the regression model as a whole is statistically significant and has high predictive capability. The significance of the model is confirmed by the fact that the probability of obtaining such results by chance is extremely low. The significance of the independent variables is indicated by the ISRC coefficient (Standardized Coefficient b) = 0.801.* This value suggests a strong positive influence of this variable on the dependent variable. The high value of the standardized coefficient b* confirms the significance of this variable in the model. The intercept = 0 and p-value = 1.000, meaning the intercept value is not statistically significant, which may indicate that the model is centered and does not include a significant constant component.

**Hypothesis confirmation**

Based on the results of the analysis, it can be concluded that there is a strong positive correlation between ISRC and the variables representing digitalization and donation tourism (as can be inferred from the significant ISRC coefficient). Therefore, these results support the hypothesis that, in wartime, digitalization and donation tourism can play a significant role in enhancing the resilience of rural communities in Ukraine. The high $R^2$ and F-statistic values confirm that these factors significantly influence community resilience, explaining a substantial proportion of the variation based on these factors.

The analysis of the impact of wars and crises on rural tourism has revealed significant economic and social consequences, as well as restrictions on access to resources and services in affected regions. For instance, Kesar (2022) emphasizes that global crises, such as wars, lead to the deglobalization of the tourism system, necessitating increased local economic resilience and the adaptation of local tourism services and resources. Our research corroborates these findings, demonstrating the need to restructure tourism to support the local economy and minimize reliance on global supply chains during crises.

Fontefrancesco et al. (2023) highlight the importance of education in Southern Europe's rural culinary tourism sector and the need for local communities and educational approaches to adapt to attract tourists and support the local economy in times of war and crisis. The results of our study align with these conclusions, showing that local communities must develop new educational and professional skills to maintain the region's attractiveness to tourists. Maliuta et al. (2022) note that wars and conflicts significantly reduce the tourist appeal of regions, leading to economic losses. Our research confirms this, emphasizing the need for strategic measures to restore and leverage regions' natural and cultural potential in the post-war period.

Ryglová et al. (2017) focus on the deterioration of infrastructure and services during wartime, which reduces the attractiveness of places for tourists. Our study further confirms the importance of rebuilding infrastructure and improving service quality to revive tourism in affected regions. Shcherbak et al. (2020) underscore the necessity of careful monitoring and strategic planning for the sustainable development of rural areas amid infrastructure destruction and limited resource access. Our research identifies key indicators for monitoring sustainable development, allowing for rapid response to changes and coordinated recovery efforts.

Kolodiziev et al. (2024) show that military conflicts significantly undermine rural tourism, decreasing tourist numbers and revenues. Our research confirms these findings, demonstrating similar trends in regions such as Kherson, Luhansk, and Donetsk.

Thus, the literature review and the results of our research converge on the point that the economic consequences of wars for rural areas include infrastructure deterioration, reduced tourist appeal, economic losses, and the need for local economic adaptation. The social consequences of wars include declining quality of life, increased social tension, and population migration. The experiences of other countries and the use of digital technologies, donation tourism, educational programs, and strategic planning can contribute to the recovery and development of rural areas in Ukraine during crises and wars.

## Conclusions

The study of the impact of digitalization and donation tourism on the resilience of rural communities in Ukraine during the war provided valuable data on the flexibility and adaptability of these communities. The main findings of the study include the following aspects:

Digitalization in war acts as a catalyst for rural resilience. The study found a strong correlation between the level of digitalization in rural communities and their overall resilience. The adoption of online platforms and applications for agriculture, tourism, and other vital services has significantly supported economic activity, social cohesion, and access to information. For example, using digital solutions has led to a 20-25% increase in economic activity.

Donation tourism can act as a lifeline as it has proven to be an important strategy to support rural communities in Ukraine. This type of tourism has contributed to income generation, stimulating local economies and community development. In some areas, revenues from donation tourism increased by 30%, which played an important role in mitigating the negative effects of the war.

The interconnectedness of resilience factors is observed, i.e., the study found that digitalization, donation tourism, and broader socio-economic conditions interact in complex ways to shape the overall resilience of rural communities. In particular, a 15% increase in digitalization was associated with a 10% increase in social cohesion. All of these factors increase the role of local government. Effective local governance and community engagement have been identified as key factors in successfully implementing digitalization and donation tourism initiatives. Regions with active local government involvement showed a 25% improvement in sustainability.

Prioritized investment in digital infrastructure and capacity building in rural communities is therefore recommended based on the results of the study. Supporting the development of online platforms and applications tailored to the specific needs of rural populations can improve their sustainability and economic opportunities. The study emphasizes the importance of community-led

initiatives for sustainable development. Involving local communities in their development processes showed a 20% improvement in long-term sustainability.

Strengthening international cooperation and partnerships can provide the necessary resources and expertise to support rural communities in Ukraine, which confirms the need for further research to explore the long-term impact of digitalization and donation tourism on rural communities, as well as to identify emerging trends and challenges. The study of sustainability of rural territorial communities (RTC) included assessment of social, economic, environmental, and institutional sustainability, with indices ranging from very low to very high levels.

The most typical representatives of the quadrant of rural territories with a very high level of sustainability (81-100) are Komishanska (84), Mykolaivska (83), Grunska (86), which showed the best results, indicating solid and sustainable development. Most of the communities with high levels of sustainability (61-80) showed high results, e.g., Bilopilska (67.7), Berezivska (74.9), Verkhnyosirovatska (68.4), confirming strengths in several dimensions of sustainability. Communities with moderate levels of resilience (41-60) require additional efforts to improve in some areas.

The cluster analysis identified groups of communities with similar resilience characteristics, allowing specific strategies and support measures to be identified for each group. This made it possible to develop practical recommendations for communities in each group.

Thus, for communities with moderate and low levels of resilience, the development and implementation of targeted support programs is recommended. For communities with high and very high levels of resilience, it is recommended to focus on maintaining and building on what has been achieved. These findings emphasize the importance of an integrated approach to assessing and supporting the sustainable development of rural territorial communities, considering social, economic, environmental, and institutional aspects.

## Appendix A

INPUT DATA FOR ASSESSING THE SUSTAINABILITY OF UTCS IN THE SUMY REGION (2023)

| № | United Territorial Community | HDI | PR | AEH | SC | ED | UR | HI | FS | EQ | NRU | CCR | GE | RoL | CP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Andriyashivska | 0.789 | 0.10 | 0.85 | 0.76 | 0.61 | 0.07 | 5500 | 0.97 | 0.72 | 0.65 | 0.81 | 0.69 | 0.75 | 0.67 |
| 2 | Bilopilska | 0.754 | 0.12 | 0.82 | 0.71 | 0.53 | 0.09 | 5200 | 0.94 | 0.69 | 0.60 | 0.79 | 0.62 | 0.70 | 0.63 |
| 3 | Berezivska | 0.812 | 0.08 | 0.88 | 0.79 | 0.64 | 0.06 | 6000 | 0.98 | 0.75 | 0.68 | 0.84 | 0.72 | 0.78 | 0.70 |
| 4 | Boromlyanska | 0.798 | 0.11 | 0.86 | 0.74 | 0.58 | 0.08 | 5700 | 0.96 | 0.73 | 0.63 | 0.82 | 0.70 | 0.76 | 0.68 |
| 5 | Bochechkivska | 0.721 | 0.15 | 0.78 | 0.67 | 0.51 | 0.11 | 4900 | 0.92 | 0.66 | 0.57 | 0.76 | 0.59 | 0.66 | 0.61 |

INPUT DATA FOR ASSESSING THE SUSTAINABILITY OF UTCS IN THE SUMY REGION (2023) (CONT.)

| № | United Territorial Community | HDI | PR | AEH | SC | ED | UR | HI | FS | EQ | NRU | CCR | GE | RoL | CP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | Burynska | 0.835 | 0.07 | 0.90 | 0.82 | 0.67 | 0.05 | 6300 | 0.99 | 0.77 | 0.70 | 0.86 | 0.74 | 0.80 | 0.72 |
| 7 | Verkhn.Syrovatskaya | 0.763 | 0.13 | 0.81 | 0.70 | 0.56 | 0.10 | 5400 | 0.95 | 0.71 | 0.62 | 0.78 | 0.64 | 0.73 | 0.66 |
| 8 | Vilshanska | 0.807 | 0.09 | 0.87 | 0.77 | 0.62 | 0.07 | 5800 | 0.97 | 0.74 | 0.66 | 0.83 | 0.71 | 0.77 | 0.69 |
| 9 | Grunskaya | 0.851 | 0.05 | 0.92 | 0.84 | 0.71 | 0.04 | 6400 | 1.00 | 0.78 | 0.72 | 0.88 | 0.76 | 0.82 | 0.74 |
| 10 | Druzhbivska | 0.774 | 0.12 | 0.84 | 0.73 | 0.59 | 0.08 | 5600 | 0.96 | 0.72 | 0.64 | 0.81 | 0.68 | 0.78 | 0.59 |
| 11 | Dubovyazovskaya | 0.713 | 0.09 | 0.83 | 0.66 | 0.60 | 0.08 | 5500 | 0.88 | 0.67 | 0.63 | 0.80 | 0.68 | 0.74 | 0.67 |
| 12 | Znob-Novgorodskaya | 0.726 | 0.07 | 0.86 | 0.75 | 0.47 | 0.10 | 5700 | 0.97 | 0.61 | 0.66 | 0.82 | 0.71 | 0.76 | 0.69 |
| 13 | Kirikivska | 0.761 | 0.06 | 0.79 | 0.69 | 0.49 | 0.09 | 5300 | 0.87 | 0.68 | 0.60 | 0.77 | 0.63 | 0.71 | 0.64 |
| 14 | Komyshanskaya | 0.822 | 0.11 | 0.89 | 0.55 | 0.51 | 0.07 | 5900 | 0.99 | 0.65 | 0.69 | 0.84 | 0.73 | 0.79 | 0.71 |
| 15 | Korovinskaya | 0.783 | 0.08 | 0.81 | 0.53 | 0.67 | 0.08 | 5600 | 0.96 | 0.72 | 0.64 | 0.81 | 0.68 | 0.74 | 0.67 |
| 16 | Krasnopilskaya | 0.800 | 0.08 | 0.87 | 0.76 | 0.61 | 0.07 | 5800 | 0.97 | 0.74 | 0.66 | 0.83 | 0.70 | 0.77 | 0.69 |
| 17 | Krolevetska | 0.776 | 0.12 | 0.82 | 0.70 | 0.54 | 0.10 | 5400 | 0.94 | 0.69 | 0.61 | 0.79 | 0.65 | 0.72 | 0.65 |
| 18 | Mykolaivska (Bilopilskyi district) | 0.809 | 0.09 | 0.88 | 0.77 | 0.62 | 0.07 | 5700 | 0.97 | 0.73 | 0.66 | 0.83 | 0.71 | 0.77 | 0.69 |
| 19 | Mykolaivska | 0.792 | 0.10 | 0.85 | 0.74 | 0.59 | 0.08 | 5500 | 0.96 | 0.71 | 0.63 | 0.81 | 0.68 | 0.74 | 0.67 |
| 20 | Miropilska | 0.815 | 0.07 | 0.89 | 0.78 | 0.64 | 0.06 | 6000 | 0.98 | 0.75 | 0.68 | 0.84 | 0.72 | 0.78 | 0.70 |
| 21 | Nedryhaylivska | 0.764 | 0.13 | 0.81 | 0.70 | 0.56 | 0.10 | 5400 | 0.95 | 0.71 | 0.62 | 0.78 | 0.64 | 0.73 | 0.66 |
| 22 | Nyzhnosyrovatska | 0.781 | 0.11 | 0.83 | 0.72 | 0.57 | 0.09 | 5600 | 0.96 | 0.72 | 0.63 | 0.81 | 0.68 | 0.74 | 0.67 |
| 23 | Novoslobidska | 0.798 | 0.08 | 0.86 | 0.74 | 0.60 | 0.07 | 5800 | 0.97 | 0.74 | 0.66 | 0.83 | 0.70 | 0.77 | 0.69 |
| 24 | Stepanivska | 0.813 | 0.07 | 0.88 | 0.77 | 0.63 | 0.06 | 6000 | 0.98 | 0.75 | 0.68 | 0.84 | 0.72 | 0.78 | 0.70 |
| 25 | Trostyanetska | 0.767 | 0.12 | 0.82 | 0.70 | 0.55 | 0.09 | 5400 | 0.95 | 0.71 | 0.62 | 0.78 | 0.64 | 0.73 | 0.66 |
| 26 | Khotinskaya | 0.801 | 0.08 | 0.87 | 0.75 | 0.60 | 0.07 | 5800 | 0.97 | 0.74 | 0.66 | 0.83 | 0.70 | 0.77 | 0.69 |
| 27 | Chernechchinskaya | 0.776 | 0.12 | 0.82 | 0.71 | 0.54 | 0.10 | 5500 | 0.94 | 0.69 | 0.61 | 0.79 | 0.65 | 0.72 | 0.65 |
| 28 | Chupakhivska | 0.789 | 0.10 | 0.84 | 0.73 | 0.58 | 0.08 | 5600 | 0.96 | 0.72 | 0.63 | 0.81 | 0.68 | 0.74 | 0.67 |
| 29 | Shalyginskaya | 0.806 | 0.07 | 0.88 | 0.77 | 0.63 | 0.06 | 6000 | 0.98 | 0.75 | 0.68 | 0.84 | 0.72 | 0.78 | 0.70 |
| 30 | Shostkinskaya | 0.759 | 0.13 | 0.81 | 0.69 | 0.56 | 0.10 | 5400 | 0.93 | 0.68 | 0.60 | 0.77 | 0.64 | 0.71 | 0.6 |

## Appendix B

ESTIMATED DATA OF ASSESSMENT OF THE USE OF ONLINE PLATFORMS OF RURAL AND DONATION-TOURISM OF SUMY REGION (2023)

| № | United Territorial Community | CR | AOV | ROI | CSR | AC | EI | PL | TS |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Andriyashivska | 4.2 | 500 | 15 | 85 | 50 | 2.1 | 70 | 80 |
| 2 | Bilopilska | 3.5 | 550 | 14 | 80 | 55 | 2.0 | 65 | 75 |
| 3 | Berezivska | 4.0 | 600 | 16 | 87 | 60 | 2.2 | 72 | 82 |
| 4 | Boromlyanska | 3.8 | 520 | 15 | 83 | 52 | 2.1 | 68 | 78 |
| 5 | Bochechkivska | 3.0 | 470 | 12 | 77 | 47 | 1.8 | 62 | 70 |
| 6 | Burynska | 4.5 | 650 | 18 | 90 | 65 | 2.3 | 75 | 85 |
| 7 | Verkhnyaya Syrovatskaya | 3.6 | 530 | 14 | 81 | 53 | 2.0 | 66 | 76 |
| 8 | Vilshanska | 4.3 | 620 | 17 | 88 | 62 | 2.4 | 73 | 83 |
| 9 | Grunskaya | 5.0 | 700 | 20 | 92 | 70 | 2.5 | 78 | 88 |
| 10 | Druzhbivska | 4.1 | 540 | 16 | 85 | 54 | 2.2 | 69 | 81 |
| 11 | Dubovyazovskaya | 3.9 | 510 | 15 | 84 | 51 | 2.1 | 67 | 79 |
| 12 | Znob-Novgorodskaya | 4.2 | 580 | 17 | 86 | 58 | 2.3 | 71 | 82 |
| 13 | Kirikivska | 3.7 | 500 | 14 | 82 | 50 | 2.0 | 65 | 75 |
| 14 | Komyshanskaya | 4.4 | 630 | 18 | 89 | 63 | 2.4 | 74 | 84 |
| 15 | Korovinskaya | 4.1 | 550 | 16 | 85 | 55 | 2.2 | 69 | 81 |
| 16 | Krasnopilskaya | 4.3 | 600 | 17 | 87 | 60 | 2.3 | 72 | 83 |
| 17 | Krolevetska | 3.9 | 530 | 15 | 84 | 53 | 2.1 | 67 | 79 |
| 18 | Mykolaivska (Bilopilskyi district) | 4.3 | 620 | 17 | 88 | 62 | 2.3 | 73 | 83 |
| 19 | Mykolaivska | 4.0 | 580 | 16 | 86 | 58 | 2.2 | 71 | 81 |
| 20 | Miropilska | 4.4 | 640 | 18 | 89 | 64 | 2.4 | 74 | 84 |
| 21 | Nedryhaylivska | 3.8 | 550 | 15 | 84 | 55 | 2.1 | 68 | 79 |
| 22 | Nyzhnosyrovatska | 4.1 | 590 | 16 | 85 | 59 | 2.2 | 70 | 81 |
| 23 | Novoslobidska | 4.3 | 600 | 17 | 87 | 60 | 2.3 | 72 | 83 |
| 24 | Stepanivska | 4.2 | 610 | 17 | 86 | 61 | 2.3 | 71 | 82 |
| 25 | Trostyanetska | 3.7 | 530 | 14 | 82 | 53 | 2.0 | 65 | 75 |
| 26 | Khotinskaya | 4.2 | 590 | 17 | 86 | 59 | 2.3 | 70 | 82 |
| 27 | Chernechchinskaya | 3.8 | 540 | 15 | 84 | 54 | 2.1 | 66 | 78 |
| 28 | Chupakhivska | 4.0 | 570 | 16 | 85 | 57 | 2.2 | 68 | 80 |
| 29 | Shalyginskaya | 3.8 | 550 | 15 | 84 | 55 | 2.1 | 67 | 79 |
| 30 | Shostkinskaya | 3.5 | 530 | 14 | 82 | 53 | 2.0 | 65 | 75 |

## Appendix C

RESULTS OF THE SUSTAINABILITY ASSESSMENT OF THE UTCS OF THE SUMY REGION OF UKRAINE (2023)

| № | United Territorial Community | SS | EnS | EcS | IS | ISRC |
|---|---|---|---|---|---|---|
| 1 | Andriyashivska | 0.751 | 0.603 | 0.728 | 0.724 | 0.703 |
| 2 | Bilopilska | 0.717 | 0.551 | 0.681 | 0.693 | 0.677 |
| 3 | Berezivska | 0.807 | 0.632 | 0.745 | 0.766 | 0.749 |
| 4 | Boromlyanska | 0.774 | 0.598 | 0.723 | 0.731 | 0.711 |
| 5 | Bochechkivska | 0.688 | 0.531 | 0.649 | 0.656 | 0.622 |
| 6 | Burynska | 0.832 | 0.661 | 0.767 | 0.785 | 0.762 |
| 7 | Verkhnyaya Syrovatskaya | 0.731 | 0.567 | 0.705 | 0.718 | 0.684 |
| 8 | Vilshanska | 0.820 | 0.860 | 0.770 | 0.770 | 0.810 |
| 9 | Grunskaya | 0.880 | 0.940 | 0.820 | 0.800 | 0.860 |
| 10 | Druzhbivska | 0.777 | 0.870 | 0.740 | 0.730 | 0.780 |
| 11 | Dubovyazovskaya | 0.750 | 0.820 | 0.730 | 0.720 | 0.770 |
| 12 | Znob-Novgorodskaya | 0.780 | 0.910 | 0.790 | 0.750 | 0.810 |
| 13 | Kirikivska | 0.740 | 0.820 | 0.720 | 0.710 | 0.760 |
| 14 | Komyshanskaya | 0.840 | 0.920 | 0.810 | 0.780 | 0.850 |
| 15 | Korovinskaya | 0.780 | 0.870 | 0.740 | 0.730 | 0.780 |
| 16 | Krasnopilskaya | 0.820 | 0.910 | 0.790 | 0.750 | 0.810 |
| 17 | Krolevetska | 0.770 | 0.860 | 0.750 | 0.720 | 0.780 |
| 18 | Mykolaivska (Bilopilskyi district) | 0.820 | 0.860 | 0.770 | 0.770 | 0.810 |
| 19 | Mykolaivska | 0.800 | 0.850 | 0.750 | 0.730 | 0.780 |
| 20 | Miropilska | 0.840 | 0.920 | 0.800 | 0.780 | 0.850 |
| 21 | Nedryhaylivska | 0.760 | 0.880 | 0.760 | 0.730 | 0.790 |
| 22 | Nyzhnosyrovatska | 0.780 | 0.870 | 0.750 | 0.730 | 0.780 |
| 23 | Novoslobidska | 0.820 | 0.860 | 0.770 | 0.770 | 0.810 |
| 24 | Stepanivska | 0.813 | 0.880 | 0.770 | 0.770 | 0.810 |
| 25 | Trostyanetska | 0.767 | 0.820 | 0.730 | 0.720 | 0.770 |
| 26 | Khotinskaya | 0.801 | 0.870 | 0.770 | 0.750 | 0.810 |
| 27 | Chernechchinskaya | 0.776 | 0.820 | 0.730 | 0.720 | 0.770 |
| 28 | Chupakhivska | 0.789 | 0.840 | 0.732 | 0.718 | 0.749 |
| 29 | Shalyginskaya | 0.772 | 0.828 | 0.739 | 0.727 | 0.671 |
| 30 | Shostkinskaya | 0.745 | 0.833 | 0.742 | 0.723 | 0.598 |

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**Valeriia Shcherbak:** Methodology, Original Draft.
**Liudmyla Dorokhova:** Data Curation.
**Svitlana Tereshchenko:** Review & Editing.
**Oleksandr Dorokhov:** Conceptualization, Validation.
**Valentyna Yatsenko:** Analysis.
**Oleksii Yermolenko:** Visualization.
All authors approved the final version of the manuscript.

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