DOI: 10.55643/fcaptp.1.66.2026.5028

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Received: 15/10/2025
Accepted: 26/01/2026
Published: 28/02/2026

FINANCIAL MECHANISMS AND INVESTMENT RISK ASSESSMENT FOR IMPLEMENTING PUBLIC-PRIVATE PARTNERSHIPS IN SUSTAINABLE TOURISM UNDER WARTIME CONDITIONS

ABSTRACT

This paper develops a financial and risk-based analytical framework for evaluating the feasibility of public-private partnerships (PPPs) in the sustainable tourism sector of Ukraine under wartime conditions. The study focuses on identifying viable financial mechanisms, investment instruments, and risk mitigation strategies that can ensure the continuity and recovery of tourism infrastructure amid fiscal constraints and security challenges. The proposed methodology integrates institutional, economic, financial, and social indicators with quantitative tools for risk assessment, including the Risk Priority Number (RPN) method and multi-criteria evaluation, to form a composite index of financial and investment readiness for PPP implementation.

Empirical data were derived from official statistics, regional development programmes, and expert surveys involving 112 specialists from government, academia, and industry. The findings reveal significant regional differentiation in both financial capacity and risk exposure. Western regions such as Lviv, Ivano-Frankivsk, and Transcarpathia demonstrate strong investment potential and resilience (0.70–0.87), while central regions exhibit moderate readiness (0.55–0.69) and southern and eastern regions face critical financial and security constraints (<0.55). The analysis shows that limited access to green and concessional financing, high capital costs, and macroeconomic instability are the main financial risks affecting PPP performance in tourism.

The research concludes that the success of PPPs in sustainable tourism depends on institutional maturity, financial innovation, and effective risk allocation between public and private partners. Strengthening fiscal capacity, introducing blended financing models, and expanding access to international and investment instruments are essential for the post-war revitalisation of Ukraine's tourism sector. The proposed methodology provides policy-makers with a replicable tool for assessing financial sustainability, prioritising investment projects, and designing adaptive PPP mechanisms that balance profitability with socio-economic and environmental objectives.

Keywords: public-private partnership, sustainable tourism, financial mechanisms, investment risk assessment, blended financing, resilience, wartime economy, resource provision, reconstruction, scenario modelling

JEL Classification: L83, O18, H54

INTRODUCTION

The outbreak of full-scale war in Ukraine has created a complex and unstable environment that has significantly influenced the functioning of the national economy and the tourism sector in particular. The destruction of infrastructure, the forced displacement of the population, and the decline in investment attractiveness have undermined the traditional financial mechanisms of regional development. Under these conditions, the search for alternative models of resource mobilisation and post-war recovery has become an urgent national priority. One of the most promising tools for achieving this

objective is the mechanism of public-private partnership (PPP), which enables the pooling of public and private resources to implement socially significant projects, stimulate investment activity, and improve the quality of tourism infrastructure and services.

The financial dimension of public-private partnerships (PPPs) in sustainable tourism under wartime conditions plays a decisive role in determining project feasibility and long-term viability. The structure of PPP financing in Ukraine is currently undergoing transformation due to the reorientation of investment flows towards reconstruction and resilience building. Under these circumstances, three major sources of funding can be identified: (1) state and municipal budgets; (2) private investment, including domestic and foreign capital; and (3) international financial aid and green financing instruments.

According to Semyanchuk et al. (2023), the financial mechanism of PPPs in wartime Ukraine relies on mixed funding models where up to 60% of capital comes from international grants or concessional loans, while private partners provide co-financing for infrastructure modernisation, digitalisation, and service improvement. This approach reduces fiscal pressure on local authorities while maintaining investment incentives for private entities.

In the tourism sector, the most common forms of PPP financing include concession agreements, lease-based partnerships, and service contracts with shared revenue streams. The expected return on investment (ROI) for PPP tourism projects is estimated at 8–12% under stable conditions, but may decline to 5–6% in high-risk zones. Financial risk mitigation instruments – such as state guarantees, insurance mechanisms, and blended finance – are therefore critical to ensure project sustainability.

The establishment of regional PPP investment funds and the introduction of green bonds could enhance access to capital for sustainable tourism projects. These instruments align with EU financial standards and facilitate Ukraine's integration into the European investment space. Moreover, the use of digital financial platforms for PPP management would improve transparency, reduce corruption risks, and strengthen investor confidence.

Incorporating financial evaluation metrics, such as Net Present Value (NPV), Internal Rate of Return (IRR), and payback period, into the PPP potential assessment model could further quantify economic efficiency and guide investors in project selection. This would allow policymakers to prioritise partnerships that not only contribute to sustainable recovery but also ensure fiscal prudence and return on investment in the long term.

Despite its recognised importance, the implementation of PPP in Ukraine's tourism sphere remains uneven and often ineffective due to institutional weaknesses, limited access to financing, and heightened socio-economic risks. Previous studies have mainly focused on PPP applications in transport, energy, and urban infrastructure (Chou & Pramudawardhani, 2015; Franco & Estevão, 2010), while tourism as a field of partnership-based recovery has received far less scientific attention. Moreover, the wartime context introduces new challenges – such as security threats, disrupted governance mechanisms, and donor dependency – that have not been adequately addressed in existing methodological frameworks for PPP assessment. Therefore, a systematic and multidimensional evaluation of regional PPP potential is required to identify the most capable regions and the main barriers to partnership development in the tourism domain.

The purpose of this research is to develop a comprehensive methodological framework for assessing the potential of PPP implementation in the sustainable tourism sector of Ukraine's regions under wartime conditions. The study aims to provide an analytical basis for evidence-based decision-making regarding regional priorities, investment attraction, and strategic planning of post-war recovery measures.

The research seeks to answer the following key questions:

1. What is the current level of regional PPP potential in the tourism sector of Ukraine?
2. Which economic, institutional, environmental, and social factors exert the strongest influence on PPP effectiveness?
3. How do risk factors – particularly those linked to wartime instability – modify regional PPP readiness?
4. What scenarios of PPP-based tourism recovery are most likely under different security and investment conditions?

The study tests the hypothesis that the integration of institutional, economic, social, and environmental indicators into a unified multi-criteria evaluation model allows for a more accurate and comprehensive assessment of PPP potential. Furthermore, it hypothesises that regions with higher institutional maturity, diversified economies, and established tourism networks demonstrate greater resilience and readiness for PPP implementation, even under conditions of elevated risk.

By addressing these questions, the research contributes to both theoretical and practical domains. It enriches the conceptual understanding of PPP as a driver of sustainable tourism recovery in crisis conditions and offers a replicable analytical

DOI: 10.55643/fcaptp.1.66.2026.5028

tool for policymakers. The findings are expected to support the design of targeted public policies and investment strategies aimed at revitalising the tourism industry and strengthening the regional economy during and after wartime recovery.

LITERATURE REVIEW

The concept of public-private partnerships has long been regarded as a fundamental instrument for mobilising financial resources, promoting private investment, and improving public service efficiency across various sectors, including infrastructure, energy, and urban development (Casady, Eriksson, Levitt, & Scott, 2019; Chou & Pramudawardhani, 2015; Grout, 1997). PPPs combine public authority oversight with private sector financing and operational expertise, creating hybrid mechanisms for addressing large-scale investment deficits. According to Dewatripont (2005), the design of PPP contracts and the distribution of financial risk between partners are central to achieving cost-efficiency and project sustainability. In contexts of fiscal constraints or post-conflict recovery, PPPs serve as a strategic policy tool to attract private capital and share investment risks (Franco & Estevão, 2010; Rocca, 2025).

Within the tourism sector, PPPs play an increasingly important role in stimulating regional economic development, diversifying financial flows, and supporting sustainable infrastructure investment (Bayekeyev, Kalenova, Seitimova, & Beysembinova, 2022; Zyma & Lisitsyna, 2014; Malik & Kaur, 2020). Franco and Estevão (2010) emphasise that tourism-oriented PPPs can mobilise private investment to upgrade public amenities, rehabilitate heritage sites, and develop eco-tourism infrastructure. Similarly, Zyma and Lisitsyna (2014) highlight that the financial architecture of tourism PPPs – comprising credit guarantees, blended finance, and revenue-sharing models – directly determines their long-term viability. In transitional economies, the alignment between investment mechanisms and institutional frameworks is particularly crucial for ensuring risk-adjusted returns and maintaining investor confidence.

The reviewed literature indicates that the success of PPPs hinges on a complex interplay of institutional, financial, economic, and environmental factors. Ablaev and Akhmetshina (2016) underscore that institutional maturity, governance transparency, and access to credit markets determine the financial feasibility of partnerships. Mishenina and Dvorak (2022) demonstrate that sustainable financing mechanisms, including green bonds and concessional loans, are increasingly incorporated into PPP projects to promote ecological responsibility and financial stability. Financial risk, in particular, emerges as a decisive constraint: macroeconomic volatility, inflation, and limited domestic capital hinder PPP implementation, especially in high-risk regions (Thompson & Arowosafe, 2021; Zheng, Liu, Jiang, Thomas, & Su, 2021).

Recent studies have advanced quantitative and multi-criteria approaches for evaluating both financial and institutional readiness for PPP implementation. Casady et al. (2019) proposed an institutional maturity model that links governance structures with financial capability, while Malik and Kaur (2020) developed a multi-dimensional index integrating investment attractiveness, fiscal solvency, and social engagement. These frameworks provide an analytical foundation for assessing PPP potential under uncertainty, particularly in fragile or post-conflict environments.

The wartime context introduces a new spectrum of financial and investment risks that transform the logic of PPP evaluation. Security threats, the destruction of infrastructure, disrupted fiscal flows, and donor dependency significantly affect financial sustainability and risk-sharing mechanisms (Krylova & Hlushchenko, 2025; Semyanchuk, Berezivska, Dydiv, Lisovskyi, & Nesteruk, 2023). Grytsyshen, Sergiienko, and Ksendzuk (2020) emphasise that integrating resilience-based financing and adaptive governance can enhance the stability of PPPs in adverse environments. International organisations, including the World Bank, OECD, and UNWTO, advocate for data-driven models that combine financial analytics, risk mapping, and expert assessment to inform PPP investment decisions in complex settings (World Bank, n.d.; OECD, 2024; UNWTO, n.d.).

In summary, the reviewed literature highlights that effective PPP implementation in tourism depends on well-structured financial mechanisms, balanced risk allocation, and diversified investment sources. However, most existing studies overlook the wartime financial dynamics and the associated investment risk environment in Ukraine. This gap underscores the relevance of the present study, which aims to develop a comprehensive methodology for assessing financial mechanisms and investment risks in PPP-based sustainable tourism development under wartime conditions.

AIMS AND OBJECTIVES

The main aim of this research is to develop and validate a financial and investment risk assessment framework for evaluating the feasibility and sustainability of public-private partnerships in the development of sustainable tourism across the regions of Ukraine under wartime conditions. The study focuses on analysing the structure and efficiency of financial

mechanisms, sources of capital mobilisation, and risk factors that affect the investment viability of PPP projects in a high-uncertainty environment.

To achieve this aim, the study sets out the following specific objectives:

1. To identify and evaluate the financial, institutional, economic, and social determinants influencing PPP implementation in the tourism sector under conditions of fiscal and security instability.
2. To analyse existing financial mechanisms and models of PPP funding, including state budgets, private capital, concessional loans, and international green financing instruments.
3. To design an integrated multi-criteria and quantitative model for assessing investment readiness and financial sustainability of PPP projects in tourism.
4. To apply risk assessment tools, including the Risk Priority Number (RPN) and sensitivity analysis, to quantify and prioritise financial and investment risks affecting PPP effectiveness; to develop a regional classification system reflecting both investment potential and risk exposure across Ukraine's tourism regions.
5. To conduct scenario-based modelling to forecast financial outcomes of PPP projects under different macroeconomic and security conditions.
6. To formulate policy recommendations aimed at enhancing fiscal capacity, improving risk-sharing mechanisms, and facilitating access to diversified financing sources for post-war tourism recovery.

Through these objectives, the research seeks to create a replicable methodological and analytical framework that can support evidence-based financial decision-making, optimise risk management, and ensure sustainable investment strategies for tourism development through PPPs in wartime and post-war Ukraine.

METHODS

This study adopts a mixed-methods approach, combining quantitative and qualitative techniques to evaluate the feasibility and potential of implementing public-private partnerships for sustainable tourism development across Ukrainian regions under wartime conditions. A structured online survey was conducted among 112 experts representing government institutions (29%), academia (34%), and the tourism industry (37%). Participants assessed the relevance of selected indicators and the intensity of associated risks on a five-point scale, providing insights into institutional readiness, economic viability, environmental sustainability, and social factors influencing PPP implementation. The collected survey data were analysed using statistical software to identify patterns, correlations, and regional differentiations.

In addition, in-depth semi-structured interviews were conducted with 12 key stakeholders, including representatives of local authorities, tourism operators, and community leaders. These interviews offered detailed perspectives on the challenges, opportunities, and contextual realities of PPP implementation during wartime.

The study applies a multi-criteria evaluation model integrating institutional, economic and financial, environmental, and social dimensions. Institutional analysis assessed the legal and regulatory frameworks supporting PPPs, while economic evaluation considered financial mechanisms, investment potential, and fiscal capacity. The environmental assessment examined sustainability practices and ecological impacts, and the social evaluation focused on community engagement and socio-economic benefits. These dimensions were weighted according to expert input, producing a composite index reflecting the readiness of each region for PPP implementation.

A Risk Priority Number (RPN) methodology was employed to quantify and prioritise risks affecting PPP projects. This involved identifying potential risks, evaluating their likelihood and severity, and calculating RPN scores to support evidence-based decision-making.

Finally, scenario modelling techniques were applied to forecast potential outcomes of PPP initiatives under varying security conditions, infrastructure statuses, and investment flows. This approach enabled the simulation of multiple post-war recovery scenarios, highlighting the implications for sustainable tourism development and informing strategic planning for regional PPP deployment.

DOI: 10.55643/fcaptp.1.66.2026.5028

RESULTS

Assessment of the Potential for Implementing Public-Private Partnerships in the Development of Sustainable Tourism in Ukrainian Regions under Martial Law Conditions

To determine the potential for implementing public-private partnerships in the sustainable tourism sector of Ukrainian regions, a staged approach was employed, combining multi-criteria analysis, integrated ranking, and spatial visualisation of the results. The assessment methodology takes into account economic, institutional, social, and environmental factors, as well as the specificities of military-economic risks.

At the first stage, key criteria characterising the readiness of regions to implement PPPs in the tourism sector were selected. Economic indicators included capital investment volumes in tourism, the development level of transport and hotel infrastructure, tourist flows, and investment attractiveness. The institutional block encompassed the existence of regional tourism development programmes, prior experience in implementing PPP projects, and the capacity of local government authorities. Socio-environmental indicators reflected employment levels in tourism, the ecological sustainability of recreational zones, and the impact of military actions on the security environment. Table 1 summarises the system of criteria for assessing the potential for PPP implementation in the development of sustainable tourism in Ukrainian regions under martial law, with a brief justification for each indicator.

The indicators selected for Table 1 reflect the key aspects of regional readiness for the implementation of public-private partnerships in the tourism sector. The economic criteria consider investment capacity, volumes of capital investment in tourism, financial stability, and economic diversification, allowing an assessment of the potential to attract both private and public resources for project implementation. This rationale is supported by the studies of Ablaev and Akhmetshina (2016), Bayekeyev et al. (2022), and Franco and Estevão (2010), which emphasise the importance of economic potential for the effective realisation of PPPs. Institutional indicators focus on the legal and administrative readiness of regions, including the existence of regulatory frameworks, the competence of local authorities, and transparency in processes, in line with the findings of Casady et al. (2019) and Diachek and Miroshnichenko (2025). Socio-environmental criteria account for employment levels in the tourism sector, the resilience of ecological infrastructure, and the impact of military actions, reflecting social and security risks to PPP implementation, as noted by Zyma and Lisitsyna (2014), Wijaya and Camba (2021), and Franco and Estevão (2010). Additionally, indicators of digital readiness and participation in international recovery programmes are included to capture innovative and restorative aspects, supported by the research of Alazzam et al. (2023) and D'Albergo et al. (2018). This structure of criteria ensures a comprehensive and balanced assessment of regional potential for the implementation of public-private partnerships in sustainable tourism.

Table 1. System of criteria for assessing the potential for implementing public-private partnerships in sustainable tourism in Ukrainian regions under martial law conditions.

Criteria Block	Criterion	Effect	Justification for Inclusion
Economic	Level of tourism-related investment (xj1)	Stimulant	Reflects the capacity and willingness of private investors to finance tourism projects even under risky conditions.
	State and donor funding for tourism infrastructure recovery (xj2)	Stimulant	Indicates the region's ability to attract public and international aid for PPP-based reconstruction projects.
	Diversification of the regional economy (xj3)	Stimulant	More diversified regional economies are less vulnerable to shocks and more attractive for PPP investments.
	Share of tourism in regional GDP (xj4)	Stimulant	Demonstrates the economic importance of tourism and the potential return for public and private partners.
	Financial solvency and creditworthiness of local authorities (xj5)	Stimulant	Determines the ability of municipalities to co-finance and maintain PPP projects.
Institutional	Existence and quality of regional PPP frameworks and legislation (xj6)	Stimulant	Reflects the legal and procedural readiness to initiate and manage PPP projects.
	Administrative and managerial competence of local authorities (xj7)	Stimulant	Evaluates institutional maturity and the ability to coordinate multi-stakeholder partnerships.
	Transparency and anti-corruption environment (xj8)	Stimulant	Ensures investor trust and safeguards the integrity of PPP contracts, especially in recovery projects.
Socio-Environmental	Employment level in tourism and related industries (xj9)	Stimulant	Indicates social stability and the contribution of tourism to local livelihoods.
	Environmental resilience and sustainability of tourism zones (xj10)	Stimulant	Reflects the ability to maintain tourism potential while ensuring ecological safety.
	Impact of military actions on infrastructure and security (xj11)	Destimulant	High intensity of attacks, destruction, or proximity to frontlines significantly reduces PPP feasibility and investment security.
Recovery and Innovation	Digitalisation and smart-tourism readiness (xj12)	Stimulant	Determines technological capability to implement modern, transparent, and resilient PPP projects.
	Engagement in international recovery or donor programmes (xj13)	Stimulant	Signals integration into global recovery networks and access to co-financing mechanisms.

The information base comprised statistical data from the State Statistics Service of Ukraine, the Ministry of Economy, and the State Agency for Tourism Development, as well as data from regional development programmes and reports from international organisations (World Bank, UNWTO, OECD). Expert surveys of representatives from government authorities, the tourism industry, and academic institutions were conducted to refine the weighting of criteria.

The assessment of the potential for implementing PPPs in sustainable tourism was carried out using a combined approach, integrating expert evaluation, scoring, and subsequent analysis of mean values across the selected criteria. The methodology was based on an integrated approach, considering both objective statistical indicators (investments, tourist flows, infrastructure conditions) and subjective assessments from experts in tourism, economics, governance, public policy, and local self-government.

The evaluation covered 22 regions of Ukraine, including Vinnytsia, Volyn, Dnipropetrovsk, Zhytomyr, Transcarpathia, Zaporizhzhia, Ivano-Frankivsk, Kyiv, Kirovohrad, Lviv, Mykolaiv, Odesa, Poltava, Rivne, Sumy, Ternopil, Kharkiv, Kherson, Khmelnytskyi, Cherkasy, Chernivtsi, and Chernihiv. Donetsk, Luhansk, and the Autonomous Republic of Crimea were excluded from the analysis due to the impossibility of collecting reliable data and expert evaluations in conditions of ongoing hostilities, temporary occupation, and limited access to objective information, rendering results for these territories inaccurate or incomplete.

A total of 112 experts from various Ukrainian regions participated in the assessment. The expert group comprised representatives of government and local authorities responsible for tourism infrastructure development and PPP implementation; managers of tourism businesses (tour operators, hotel complexes, investment companies) with prior experience in PPP projects; scholars and specialists in tourism, economics, management, geography, and socio-environmental development; and representatives of non-governmental organisations supporting sustainable tourism and ecological initiatives. Experts were asked to evaluate each criterion on a scale from 1 to 5, where 1 represented the lowest potential and 5 the highest. The collected data were statistically processed to determine mean values for each criterion and to calculate an integrated index of PPP potential for individual regions. This approach enabled the combination of quantitative statistics with qualitative expert evaluations, which is particularly relevant for Ukrainian regions under martial law, where many objective indicators are partially altered or unavailable (Table 2).

Table 2. Integrated indices of the potential for implementing public-private partnerships in sustainable tourism in Ukrainian regions based on expert assessment.

Region	x_{ij1}	x_{ij2}	x_{ij3}	x_{ij4}	x_{ij5}	x_{ij6}	x_{ij7}	x_{ij8}	x_{ij9}	x_{ij10}	x_{ij11}	x_{ij12}	x_{ij13}
Vinnytsia	3.5	3.4	3.3	3.2	3.4	3.2	3.1	3.2	3.3	3.3	3	3	2.9
Volyn	2.9	2.8	3.3	2.7	2.8	2.8	2.7	2.9	2.8	3	2.5	2.6	2.5
Dnipropetrovsk	3.4	3.1	3.5	3.1	3.7	3.4	3.3	3.4	3.5	3.3	1.2	3.5	3.2
Zhytomyr	3.1	3.1	2.9	2.8	2.9	2.8	2.8	2.8	2.9	3.1	3.2	2.7	2.6
Transcarpathia	3.8	4.6	4.5	3.8	3.5	3.5	3.4	3.6	3.9	3.9	4.4	3.4	3.5
Zaporizhzhia	2.7	2.6	2.8	2.5	2.7	2.5	2.4	2.6	2.7	2.8	1.1	2.4	2.2
Ivano-Frankivsk	3.7	3.8	3.3	3.3	3.7	3.3	3.6	3.7	3.4	3.2	3.5	3.5	3.6
Kyiv	3.9	4.2	3.9	4.1	4.3	3.8	3.9	3.7	3.3	3.8	2.5	2.4	3.9
Kirovohrad	3.1	2.8	2.9	2.8	2.9	2.7	2.6	2.8	2.9	3.1	2.8	2.5	2.4
Lviv	3.8	3.3	3.8	4.3	3.7	3.5	3.9	3.8	4.3	4.2	2.5	3.4	3.8
Mykolayiv	2.9	2.8	2.6	2.8	2.7	2.6	2.5	2.6	2.9	3.1	1.8	2.4	2.2
Odesa	3.2	3.2	3.2	3.2	3.1	3.2	2.8	3.6	2.2	2.8	1.2	3.5	2.8
Poltava	3.3	3.2	3.5	3.1	3.2	3.3	2.9	3.2	3.3	3.5	1.8	2.1	2.7
Rivne	3.2	2.8	2.8	2.9	2.9	2.8	2.8	2.9	3	3.1	2.3	2.6	2.5
Sumy	1.8	2.4	2.3	2.5	2.6	2.1	2.4	2.1	2.8	2.9	1.2	2.3	2.2
Ternopil	3.4	3.2	3.2	3.3	3.2	3.1	3.3	3.1	3.4	3.5	3.1	3.1	2.9
Kharkiv	2.8	3.4	3.1	2.9	3.2	3.2	3.1	3.3	3.5	3.3	1.1	3.2	2.8
Kherson	2.3	2.1	2.1	2.2	2.2	2.1	1.9	2.1	2.4	2.5	0.8	2.1	2
Khmelnytsk	3.2	3.1	2.9	3.1	3.1	2.9	2.8	3.3	3.2	3.4	2.8	2.8	2.7
Cherkassy	3.2	3.2	2.9	3.1	3.3	2.9	2.8	2.9	3.2	3.3	2.8	2.8	2.7
Chernivtsi	3.8	3.6	3.2	3.8	3.6	3.5	3.4	3.5	3.8	3.9	3.4	3.5	3.4
Chernihiv	2.8	2.7	2.5	2.7	2.7	2.6	2.5	2.6	2.9	3.2	1.2	2.5	2.4

DOI: 10.55643/fcaptp.1.66.2026.5028

The normalised value of each indicator depends on whether it is a stimulant (higher values are favourable) or a destimulant (lower values are favourable).

1. Stimulants. For indicators where higher values indicate better performance (e.g., investment, infrastructure development, tourist flow), the normalised value is calculated as:

$$z_{ij} = x_{ij} / x_{max}, \quad (1)$$

where z_{ij} – normalised value of the i-th indicator for region j; x_{ij} – observed value of the i-th indicator for region j; x_{max} – maximum observed value of the i-th indicator across all regions.

2. Destimulants. For indicators where lower values are preferable (e.g., level of risk, negative impact of military actions), the normalised value is calculated as:

$$z_{ij}=x_{min} / x_{ij}, \quad (2)$$

where x_{min} – minimum observed value of the i-th indicator across all regions.

This approach ensures that for both stimulants and destimulants, higher normalised values always reflect better conditions, making all indicators comparable for aggregation into a single integrated index. The integrated index for assessing the potential of PPP implementation in sustainable tourism for each region is calculated as:

$$I_j = \frac{1}{n}\sum z_{ij}, \quad (3)$$

where I_j – integrated assessment of PPP potential in sustainable tourism for region j; n – total number of indicators included in the index.

The results of the calculations are shown in Table 3.

Table 3. Normalised indicators and integrated assessment of the potential for implementing public-private partnerships in sustainable tourism in Ukrainian regions.

Region	z_1	z_2	z_3	z_4	z_5	z_6	z_7	z_8	z_9	z_{10}	z_{11}	z_{12}	z_{13}	Ij
Vinnytsia	0.7	0.68	0.66	0.64	0.68	0.64	0.62	0.64	0.66	0.66	0.6	0.6	0.58	**0.64**
Volyn	0.58	0.56	0.66	0.54	0.56	0.56	0.54	0.58	0.56	0.6	0.5	0.52	0.5	**0.56**
Dnipropetrovsk	0.68	0.62	0.7	0.62	0.74	0.68	0.66	0.68	0.7	0.66	0.24	0.7	0.64	**0.64**
Zhytomyr	0.62	0.62	0.58	0.56	0.58	0.56	0.56	0.56	0.58	0.62	0.64	0.54	0.52	**0.58**
Transcarpathia	0.76	0.92	0.9	0.76	0.7	0.7	0.68	0.72	0.78	0.78	0.88	0.68	0.7	**0.77**
Zaporizhzhia	0.54	0.52	0.56	0.5	0.54	0.5	0.48	0.52	0.54	0.56	0.22	0.48	0.44	**0.49**
Ivano-Frankivsk	0.74	0.76	0.66	0.66	0.74	0.66	0.72	0.74	0.68	0.64	0.7	0.7	0.72	**0.70**
Kyiv	0.78	0.84	0.78	0.82	0.86	0.76	0.78	0.74	0.66	0.76	0.5	0.48	0.78	**0.73**
Kirovohrad	0.62	0.56	0.58	0.56	0.58	0.54	0.52	0.56	0.58	0.62	0.56	0.5	0.48	**0.56**
Lviv	0.76	0.66	0.76	0.86	0.74	0.7	0.78	0.76	0.86	0.84	0.5	0.68	0.76	**0.74**
Mykolayiv	0.58	0.56	0.52	0.56	0.54	0.52	0.5	0.52	0.58	0.62	0.36	0.48	0.44	**0.52**
Odesa	0.64	0.64	0.64	0.64	0.62	0.64	0.56	0.72	0.44	0.56	0.24	0.7	0.56	**0.58**
Poltava	0.66	0.64	0.7	0.62	0.64	0.66	0.58	0.64	0.66	0.7	0.36	0.42	0.54	**0.60**
Rivne	0.64	0.56	0.56	0.58	0.58	0.56	0.56	0.58	0.6	0.62	0.46	0.52	0.5	**0.56**
Sumy	0.36	0.48	0.46	0.5	0.52	0.42	0.48	0.42	0.56	0.58	0.24	0.46	0.44	**0.46**
Ternopil	0.68	0.64	0.64	0.66	0.64	0.62	0.66	0.62	0.68	0.7	0.62	0.62	0.58	**0.64**
Kharkiv	0.56	0.68	0.62	0.58	0.64	0.64	0.62	0.66	0.7	0.66	0.22	0.64	0.56	**0.60**
Kherson	0.46	0.42	0.42	0.44	0.44	0.42	0.38	0.42	0.48	0.5	0.16	0.42	0.4	**0.41**
Khmelnytsk	0.64	0.62	0.58	0.62	0.62	0.58	0.56	0.66	0.64	0.68	0.56	0.56	0.54	**0.60**
Cherkassy	0.64	0.64	0.58	0.62	0.66	0.58	0.56	0.58	0.64	0.66	0.56	0.56	0.54	**0.60**
Chernivtsi	0.76	0.72	0.64	0.76	0.72	0.7	0.68	0.7	0.76	0.78	0.68	0.7	0.68	**0.71**
Chernihiv	0.56	0.54	0.5	0.54	0.54	0.52	0.5	0.52	0.58	0.64	0.24	0.5	0.48	**0.51**

Based on the modelling results, regions were classified into three levels of potential: high, medium, and low. Regions with high potential are characterised by stable infrastructure, a developed tourism sector, the presence of regional tourism development programmes, and a relatively low negative impact of military actions on security and the economy. Regions with medium potential have reasonably developed infrastructure and tourism services but face constraints due to military risks, limited PPP experience, or lower investment attractiveness. Regions with low potential are those where infrastructure and the tourism sector have been significantly affected by hostilities, local government capacity is limited, and socio-environmental vulnerability is high.

The potential levels were defined according to the integrated index as follows (Table 4):

1. High potential: $I_j \geq 0.70$.
2. Medium potential: $0.55 \leq I_j < 0.69$.
3. Low potential: $I_j < 0.55$.

Table 4. Classification of Ukrainian Regions by PPP Potential in Sustainable Tourism and Key Recommendations.

Group	Regions	Key Challenges	Recommendations for Authorities	Recommendations for Business and Communities
I. High potential	Transcarpathia, Ivano-Frankivsk, Kyiv, Lviv, Chernivtsi	High tourist load, need for infrastructure modernisation	Active support for public-private projects in recreation and green tourism; Expansion of cross-border EU initiatives	Investment in eco- and cycle-tourism, SPA and wellness centres; Enhancement of service standards and digital accessibility
II. Medium potential	Vinnytsia, Volyn, Dnipropetrovsk, Zhytomyr, Kirovohrad, Odesa, Poltava, Rivne, Ternopil, Kharkiv, Khmelnytsk, Cherkasy	Insufficient tourism product diversification, need for branding, low investment attractiveness, and limited funding	Development of regional sustainable tourism strategies and PPP programmes; Promotion of cluster development (agro- and event tourism); Tax incentives for tourism PPP projects; Establishment of tourist information centres and investment portals	Development of family agro-estates and thematic routes; Utilisation of EU grants for modernisation; Formation of local cooperatives for eco-routes; Staff training and capacity-building
III. Low potential	Zaporizhzhia, Mykolaiv, Sumy, Kherson, Chernihiv	Infrastructure destruction, security risks	Restoration of basic infrastructure and safety; Government guarantees for PPP investors	Focus on small-scale domestic tourism; Use of renewable resources and grant programmes for reconstruction

The results indicate significant regional disparities in Ukraine with respect to the potential for implementing public-private partnerships in sustainable tourism. Regions classified as having high potential are characterised by developed infrastructure and tourism sectors, stable economies, and low negative impacts from the ongoing conflict. Regions with medium potential possess a sufficient level of service development but face limitations due to wartime risks and lower investment attractiveness. Low-potential regions have experienced substantial destruction of infrastructure and tourism facilities, demonstrated limited administrative capacity, and exhibited high socio-environmental vulnerability. These findings provide the basis for regionally tailored recommendations for government authorities and businesses, aimed at enhancing the efficiency of PPP implementation and supporting the sustainable development of the tourism sector under contemporary wartime economic challenges.

Investment Risk Assessment for the Implementation of Public-Private Partnerships in Sustainable Tourism in Ukrainian Regions

The subsequent phase of the study involves evaluating the impact of identified risks on the potential for implementing PPPs in sustainable tourism across Ukraine. Based on the results of the previously modelled integrated PPP potential index, risks may affect both the absolute values of the index and the composition of its constituent components. Specifically, risks influence the economic, institutional, and socio-environmental criteria that determine regional readiness for partnership projects.

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DOI: 10.55643/fcaptp.1.66.2026.5028

prioritisation of risks. The risk indicators affecting the implementation of public-private partnerships in sustainable tourism in Ukraine are summarised in Table 5.

Table 5. Risk Indicators Affecting the Implementation of Public-Private Partnerships in Sustainable Tourism in Ukraine.

Risk Group	Risk Indicator	Description of Impact on PPP Implementation	Potential Impact Level (Assessment)
Economic risks	High carbon intensity of the economy	Reduces the investment attractiveness of green tourism projects, increases the cost of transitioning to a sustainable model	High
	Macroeconomic instability	Complicates forecasting of revenues and expenditures in PPPs, and reduces private sector confidence	High
	Inflation and currency fluctuations	Hinders the execution of long-term contracts and budget adjustments for projects	Medium
Financial risks	Limited access to green financing	Reduces the number of low-carbon tourism projects	High
	Insufficient domestic investment resources	Limits the implementation of large-scale tourism PPPs	High
	High cost of capital	Reduces competitiveness of Ukrainian PPP projects in international markets	Medium
Institutional-legal risks	Imperfect legislative framework	Complicates contract procedures, reduces transparency in partner selection	High
	Weak mechanisms of environmental responsibility	Increases the risk of environmental standard violations in tourism projects	Medium
	Low administrative capacity	Slows decision-making, creates managerial barriers	High
Environmental risks	Depletion of natural resources	Reduces the recreational potential of regions and the long-term attractiveness of tourism	High
	Industrial pollution	Deteriorates the ecological image of regions, increases remediation costs	High
	Ecosystem degradation and biodiversity loss	Limits the development of ecotourism and nature-based recreation	High
Socio-security risks	Armed conflict and occupation of territories	Destroys tourism infrastructure, causes loss of personnel, and reduced tourist flows	Very high
	Population migration and demographic changes	Causes a shortage of skilled personnel in the tourism sector	High
	Low public safety	Limits regional attractiveness for foreign investors	High
Managerial risks	Lack of a PPP performance monitoring system	Complicates the evaluation of project effectiveness and expenditure control	Medium
	Inconsistency of strategic documents at different levels	Leads to duplication or conflict of tourism development objectives	Medium
	Low managerial staff competence	Increases the risk of inefficient resource management and project delays	Medium
Geopolitical risks	Escalation of hostilities	Blocks PPP implementation in frontline regions	Very high
	Changes in international financial aid priorities	Limits donor funding and support for tourism projects	Medium
	Geopolitical uncertainty	Reduces foreign investor confidence in long-term commitments	High

Note: The level of impact was assessed using an expert scale: Very high – the risk has a systemic character and may significantly alter the integrated PPP potential index; High – significantly affects certain index components; Medium – has a local or short-term effect.

The results of this analysis will form the basis for further quantitative risk assessment using methods such as expert weighting or fuzzy logic within the PPP potential evaluation system for sustainable tourism.

Methodology for the Quantitative Investment Risk Assessment in Implementing Public-Private Partnerships in Sustainable Tourism in Ukraine

The quantitative assessment of investment risks aims to determine the overall impact of external and internal threats on the potential for implementing public-private partnerships in the sustainable tourism sector across Ukrainian regions. A staged approach was applied, combining expert evaluation, risk weighting methods, and modification of the integrated PPP potential index.

For each risk indicator, two key characteristics are determined: the probability of the risk occurring (P_i), assessed on a scale from 1 to 5, where 1 indicates a highly unlikely event and 5 a very high probability; and the impact of the risk (I_i), also assessed on a scale from 1 to 5, where 1 indicates a negligible impact and 5 a catastrophic effect on the PPP system.

The Risk Priority Number (*RPN*) method is employed for quantitative assessment, enabling the calculation of an integrated measure of risk significance:

$$\mathrm{RPN_i} = \mathrm{P_i} \cdot \mathrm{I_i}, \quad (4)$$

where RPN_i – is the numerical priority index of risk for indicator i; P_i – is the probability of risk occurrence; I_i – is the degree of impact of the risk on the PPP system.

To ensure comparability of indicators, risks are normalised using the following formula 5:

$$\mathrm{RPN_{norm,i}} = \frac{\mathrm{RPN_i}}{\mathrm{RPN_{max}}}, \quad (5)$$

where $RPN_{norm,\ i}$ – is the normalised risk value, ranging from 0 to 1; RPN_{max} – is the maximum RPN value among all assessed risks.

The results of the quantitative risk assessment for implementing public-private partnerships in sustainable tourism in Ukraine are presented in Table 6.

Table 6. Quantitative investment risk assessment in implementing public-private partnerships in sustainable tourism in Ukraine.

Risk Group	Risk Indicator	P_i (1-5)	I_i (1-5)	*RPN*	RPN_{norm}
Economic risks	High carbon intensity of the economy	4	4	16	0.64
	Macroeconomic instability	4	4	16	0.64
	Inflation and currency fluctuations	3	3	9	0.36
Financial risks	Limited access to green financing	5	4	20	0.8
	Insufficient domestic investment	4	4	16	0.64
	High cost of capital	3	3	9	0.36
Institutional-legal risks	Inadequacy of the legislative framework	5	5	25	1
	Weak environmental accountability mechanisms	3	3	9	0.36
	Low capacity of public authorities	5	4	20	0.8
Environmental risks	Depletion of natural resources	4	5	20	0,8
	Industrial pollution	4	4	16	0,64
	Ecosystem degradation and biodiversity loss	4	4	16	0.64
Socio-security risks	Armed conflict and occupation of territories	5	5	25	1
	Population migration and demographic changes	4	4	16	0.64
	Low level of public safety	4	4	16	0.64
Managerial risks	Lack of a PPP performance monitoring system	3	3	9	0.36
	Misalignment of strategic documents	3	2	6	0.24
	Low managerial staff qualifications	3	3	9	0.36
Geopolitical risks	Escalation of hostilities	5	5	25	1
	Changes in international financial assistance priorities	3	3	9	0.36
	Geopolitical uncertainty	4	4	16	0.64

DOI: 10.55643/fcaptp.1.66.2026.5028

Institutional-legal, socio-security, and geopolitical risks have the greatest impact on the potential for PPPs in sustainable tourism, characterised by maximum values of *RPN*=25 and RPN_{norm}=1. Economic, environmental, and financial risks, as well as social changes, have a moderate impact (RPN_{norm} ranging from 0.36 to 0.8), while managerial and certain financial and economic risks are comparatively less significant (RPN_{norm} ≤0.36). This quantitative assessment enables the identification of priority areas for risk mitigation and adjustment of strategies for PPP implementation in sustainable tourism, taking into account regional specificities and the wartime economic context.

The next step involves the quantitative determination of the impact of different risk groups on the potential for PPP implementation in the regions, as well as estimating the reduction in the integrated potential index considering regional vulnerability. This enables the derivation of an adjusted assessment of a region's readiness for the implementation of public-private projects in sustainable tourism. Such an approach systematically accounts for regional specificities and wartime economic threats, identifies priority areas for risk mitigation, and supports the development of evidence-based recommendations to enhance the effectiveness of PPP implementation in tourism. Moreover, the methodology allows the integration of expert evaluations with quantitative indicators, providing a more accurate and reliable assessment of regional readiness to implement public-private projects under complex economic and security conditions.

The average value of the normalised indices for each risk group is calculated as:

$$\overline{\mathrm{RPN_g}} = \frac{1}{\mathrm{n_g}} \sum_{\mathrm{i=1}}^{\mathrm{n_g}} \mathrm{RPN_{norm,i}}, \quad (6)$$

where $\overline{RPN_g}$ – is the average normalised index for risk group g; n_g – is the number of indicators in group g.

This value characterises the average level of threat for a given risk dimension.

Based on previous calculations of PPP potential, a regional vulnerability coefficient is introduced:

$$\mathrm{V_r} = 1 - \mathrm{I_{j\ base,r}}, \quad (7)$$

where V_r – is the vulnerability coefficient of region r; $I_{j\ base,r}$ – is the baseline integrated PPP potential index for region r (prior to accounting for risks).

Subsequently, a synthetic risk score for the region is calculated as:

$$\mathrm{RISK_r} = \mathrm{V_r} \cdot \overline{\mathrm{RPN}}, \quad (8)$$

where $RISK_r$ – is the integrated risk score for the region; $\overline{RPN}$ – is the average normalised value of all risks in the system.

To convert the risk score into a proportional reduction of the integrated potential index, a linear normalisation function is used:

$$\Delta_{\mathrm{r}} = \Delta_{\min} + \frac{\mathrm{RISK_r}}{\mathrm{RISK_{max}}} (\Delta_{\max} - \Delta_{\min}), \quad (9)$$

where Δr – is the potential reduction coefficient for region r; Δ_{min}= 0.05 – minimum potential reduction (5%); Δ_{max}=0.25 – maximum potential reduction (25%); $RISK_{max}$ – maximum risk score among all regions.

After accounting for the impact of risks, the adjusted integrated index for each region is calculated as:

$$\mathrm{I_{adj,r}} = \mathrm{I_{jbaser,r}} \cdot (1 - \Delta_{\mathrm{r}}), \quad (10)$$

where $I_{adj,r}$ – is the adjusted regional potential index accounting for risks.

The results of the calculations are presented in Table 7.

Table 7. Adjusted integrated indices of potential for implementing public-private partnerships in sustainable tourism in Ukrainian regions, considering risks.

Region	Ij_{base}	V_r	$RISK_r$	Δr	$I_{adj,r}$
Vinnytsia	0.64	0.36	0.207	0.114	0.568
Volyn	0.56	0.44	0.254	0.137	0.483
Dnipropetrovsk	0.64	0.36	0.207	0.114	0.568
Zhytomyr	0.58	0.42	0.242	0.130	0.504
Transcarpathia	0.77	0.23	0.132	0.099	0.694
Zaporizhzhia	0.49	0.51	0.294	0.169	0.407
Ivano-Frankivsk	0.70	0.30	0.173	0.110	0.623
Kyiv	0.73	0.27	0.156	0.101	0.656
Kirovohrad	0.56	0.44	0.254	0.137	0.483
Lviv	0.74	0.26	0.149	0.097	0.667
Mykolayiv	0.52	0.48	0.277	0.160	0.438
Odesa	0.58	0.42	0.242	0.130	0.504
Poltava	0.60	0.40	0.230	0.125	0.525
Rivne	0.56	0.44	0.254	0.137	0.483
Sumy	0.46	0.54	0.312	0.184	0.375
Ternopil	0.64	0.36	0.207	0.114	0.568
Kharkiv	0.60	0.40	0.230	0.125	0.525
Kherson	0.41	0.59	0.340	0.200	0.328
Khmelnytsk	0.60	0.40	0.230	0.125	0.525
Cherkassy	0.60	0.40	0.230	0.125	0.525
Chernivtsi	0.71	0.29	0.167	0.108	0.632
Chernihiv	0.51	0.49	0.282	0.162	0.427

The study's findings indicate that the proposed methodology for the quantitative assessment of risks and the integrated potential for implementing public-private partnerships in sustainable tourism provides a comprehensive and reliable evaluation of the readiness of Ukrainian regions to undertake such projects. The analysis demonstrates that regions with a high baseline potential index, such as Lviv (0.74), Ivano-Frankivsk (0.70), and Transcarpathia (0.77), retain relatively high adjusted indices of 0.667, 0.623, and 0.694, respectively, after accounting for regional vulnerability and risk exposure. This reflects their resilience and relative readiness for PPP implementation.

Regions with medium potential, including Kyiv (baseline index 0.73) and Odesa (0.58), experienced reductions in their adjusted indices to 0.656 and 0.504, respectively, reflecting certain limitations imposed by economic and socio-security risks. Conversely, regions with low potential, such as Kherson (0.41), Zaporizhzhia (0.49), Mykolaiv (0.52), Sumy (0.46), and Kharkiv (0.60), display adjusted indices ranging from 0.328 to 0.525, indicating a high level of vulnerability and significant impact of risks on their capacity to implement PPPs in tourism.

The calculation of the synthetic risk score (*RISK*) demonstrates that regions with low baseline potential are characterised by considerably higher risk scores, highlighting the necessity for prioritised interventions and risk mitigation measures. The system-wide average normalised risk value was used to determine the potential reduction coefficient (Δr), which varies between 0.083 and 0.200 across regions. This allows the baseline potential indices to be adjusted in accordance with actual wartime economic and socio-environmental conditions.

Overall, the results confirm the effectiveness of an integrated approach that combines expert evaluation with quantitative indicators, enabling consideration of regional specificities and the particular nature of risks when assessing the potential for PPPs in tourism. This conclusion aligns with the findings of Chou and Pramudawardhani (2015), who demonstrated that the success of PPPs largely depends on the proper integration of risk management and regional project characteristics across different countries. In the Ukrainian context (Zyma & Lisitsyna, 2014), integrating expert assessment allows for the inclusion of unique economic and institutional conditions of regions, which is particularly crucial for post-conflict recovery of the tourism sector.

DOI: 10.55643/fcaptp.1.66.2026.5028

Economic risks, manifested through reduced investment activity and restricted capital allocation to tourism infrastructure, slow down the restoration of recreational facilities. This is consistent with the observations of Wijaya and Camba (2021), who emphasise that national economic stability and the availability of financing are critical for successful PPP implementation in high-risk regions. Under the current state of war in Ukraine, the economic component of the integrated PPP potential index may decline by 10-15%, particularly in regions with damaged transport infrastructure (Dewatripont, 2005).

Institutional and legal risks directly affect the effectiveness of PPP preparation, negotiation, and execution. Inadequacies in the regulatory framework, decision-making delays, and the lack of a unified approach to project performance assessment may reduce the institutional component of the index by up to 20%. This is consistent with Zheng et al. (2021), who found that legal uncertainty and litigation significantly decrease the likelihood of successful PPP completion, and with D'Albergo et al. (2018), who highlighted the role of political economy and state regulation in the development of urban PPPs.

Environmental risks, including the depletion of natural resources, pollution, and ecosystem degradation, create additional barriers to sustainable tourism development. Their impact is cumulative and long-term: in the absence of effective environmental protection measures, the ecological component of the index may decline by 0.05-0.10 points. Similar conclusions were drawn by Franco and Estevao (2010) and Grigoresc (2008), who emphasised that environmental stability is a key prerequisite for the long-term effectiveness of tourism-related PPPs.

Socio-security risks exert a complex effect: infrastructure destruction, internal population migration, and low levels of public safety constrain tourism development and reduce attractiveness for private investors. This is corroborated by Semyanchuk et al. (2023), who demonstrate that socio-security factors become critical under wartime conditions for the formation of effective PPPs. In certain regions, this may lead to a loss of up to 30% of the collaborative potential between the state and the private sector.

Financial risks, particularly limited access to credit and green financing, reduce private investment levels and extend project implementation timelines. This aligns with the findings of Alazzam et al. (2023) and Grout (1997), who emphasise the role of financial mechanisms and contract design in mitigating PPP risks.

In summary, the combined impact of economic, institutional-legal, environmental, socio-security, and financial risks may, in the medium term, reduce the integrated PPP potential index in the tourism sector by 0.10–0.25 points. This underscores the necessity for adaptive development scenarios, comprehensive state support measures, institutional strengthening, and strategic planning, in line with the conclusions of Hossu et al. (2018) and Papageorgiou et al. (2020) regarding the importance of an integrated risk management approach and stakeholder participation in sustainable development processes.

Scenario Analysis of the Development of Public-Private Partnerships in Sustainable Tourism

The proposed methodology for risk assessment in the field of public-private partnerships in tourism is highly comprehensive, as it considers various types of risks – economic, social, environmental, and conflict-related – that significantly influence the integrated potential of regions (Chou & Pramudawardhani, 2015; Zyma & Lisitsyna, 2014). The approach demonstrates flexibility due to its adaptability in the probability and impact scales, which can be tailored to the specifics of a particular region or tourism sector (Wijaya & Camba, 2021; Zheng et al., 2021). The methodology integrates qualitative (expert-based) and quantitative (computational) approaches, combining subjective expert assessments with objective statistical data, thereby ensuring reliability and practical relevance of the results (Alazzam et al., 2023; D'Albergo et al., 2018; Dewatripont, 2005).

Furthermore, the results can be used to develop scenario-based projections for PPP development, allowing the forecasting of potential changes in the integrated potential index under various internal and external risk conditions (Franco & Estevao, 2010; Grigoresc, 2008; Grytsyshen et al., 2020; Semyanchuk et al., 2023). Consequently, the proposed methodology provides a quantitative assessment of how military, economic, and environmental risks reduce the potential for implementing PPPs in sustainable tourism and serves as a reliable basis for risk management strategies and prioritisation in post-conflict recovery of Ukraine's tourism sector (Grout, 1997).

To evaluate the dynamics of risk impacts on the potential for PPPs in the tourism sector, three development scenarios were formulated: optimistic, baseline, and crisis. The parameters of these scenarios were determined through a comprehensive analysis of regional institutional and economic conditions, the effectiveness of environmental strategies, and the state of security. This approach is consistent with Chou and Pramudawardhani (2015), who emphasise that the effectiveness of PPPs largely depends on assessing key drivers and critical success factors while accounting for risks, which allows for scenario-based modelling of projects across different countries. Similarly, Zyma and Lisitsyna (2014) studied PPP implementation in the Ukrainian tourism sector, highlighting the need to consider regional institutional capacity and local economic conditions when forming realistic development scenarios.

Compared with the work of Wijaya and Camba (2021), which analyzes the political and spatial context of PPPs in Southeast Asia, this approach places greater emphasis on environmental and security risks, which are critically important for Ukraine under wartime conditions. Zheng et al. (2021) note that accurate PPP outcome forecasting requires consideration of potential legal and financial risks, underscoring the necessity of differentiated scenario analysis for regions with varying stability and potential. Thus, the construction of optimistic, baseline, and crisis scenarios aligns with international practice in adapting PPPs to regional characteristics and risk factors, confirming both the theoretical and practical significance of the approach (Table 8).

Table 8. Development scenarios and expected impact of risks on the potential for public-private partnerships in Ukrainian Tourism Regions.

Scenario	Key Features	Expected Integrated PPP Potential Index	Expected Outcomes
Optimistic	Rapid stabilisation of security; restoration of transport infrastructure; attraction of international green financing; improvement of the PPP legal framework	0.70-0.85	Active restoration of tourism infrastructure; formation of new partnership models; development of ecotourism and digital services; enhancement of cross-border projects
Baseline	Moderate stabilisation; partial infrastructure recovery; limited investment inflows; gradual legislative improvements	0.55-0.69	Development of PPPs at the local level; slow infrastructure modernisation; dependence on international grants; fragmented business participation
Crisis	Prolonged instability; destruction of logistics; low financing levels; absence of legal incentives	<0.55	Curtailment of most PPP projects; increase in informal business; decline of tourism infrastructure; intensification of regional disparities

Scenario analysis confirms that the level of institutional maturity and regional capacity to manage risks are key determinants for successful PPP implementation in tourism. Under the optimistic scenario, which assumes rapid security recovery, infrastructure modernisation, and support from international financial mechanisms, the integrated PPP potential index in high-ranking regions, such as Lviv, Ivano-Frankivsk, and Odesa, could increase to 0.90-0.92, facilitating the transformation of local initiatives into sustainable investment models and active development of ecotourism and digital services. These findings align with Chou and Pramudawardhani (2015), who highlight the critical role of institutional capacity and proper risk allocation for effective PPP project implementation internationally.

The baseline scenario, considered the most likely in the medium term, maintains potential levels at 0.6-0.7, with a focus on regional agro-tourism and eco-innovation projects, and PPP support through municipal centres. This supports the conclusions of Zyma & Lisitsyna (2014) regarding the importance of adapting PPP models to local contexts where institutional and financial resources are limited. Wijaya & Camba (2021) also note that in countries with unstable economic and political environments, PPP projects often shift toward local initiatives, which corresponds to the Ukrainian medium-development scenario.

The crisis scenario, based on persistently high military risks and absence of international support, predicts a reduction of the potential index to 0.4-0.5. Such conditions are typical for frontline regions, where PPP implementation is feasible only in limited forms, for instance, in domestic social tourism or local eco-projects involving community organisations. Similar trends are observed in international studies analysing PPPs in high-risk zones (D'Albergo et al., 2018; Dewatripont, 2005), where social-security and financial constraints significantly reduce the effectiveness of partnership models.

Practical conclusions indicate the necessity of integrating risk assessment into the PPP management system to enhance the reliability of the integrated index results and scenario planning. Institutional resilience and access to EU financial instruments will determine the capacity of regions to transition from the baseline to the optimistic scenario, as confirmed by Semyanchuk et al. (2023) on the effectiveness of PPP financial mechanisms under wartime conditions. Environmental security and green infrastructure modernisation serve as key drivers in reducing systemic risks and building competitive advantages for tourism regions, consistent with Franco & Estevao (2010) and Grigoresc (2008), who emphasise the importance of sustainable development for PPPs in tourism.

The scenario-based approach allows the adaptation of PPP policies to wartime conditions, supporting strategic planning, investment risk assessment, and projection of sector recovery trajectories. As indicated by Hossu et al. (2018) and Papageorgiou et al. (2020), integrating socio-economic, environmental, and financial factors in scenario modelling enhances the effectiveness of partnership initiatives in high-risk zones.

DOI: 10.55643/fcaptp.1.66.2026.5028

Therefore, wartime risks significantly influence the dynamics of PPP implementation in sustainable tourism. However, with institutional stabilisation, development of green financing, and international support, PPPs can become a key mechanism for post-conflict recovery and sustainable development of Ukraine's tourism sector, as corroborated by Zyma & Lisitsyna (2014), Dewatripont (2005), and Semyanchuk et al. (2023).

DISCUSSION

The results of this study reveal a clear differentiation in the potential for implementing public-private partnerships (PPPs) across Ukrainian regions under wartime conditions, reflecting the combined influence of institutional maturity, fiscal resilience, and exposure to investment risk. Western regions, such as Lviv, Ivano-Frankivsk, and Zakarpattia, demonstrate high PPP potential due to stable administrative systems, diversified economies, and comparatively lower financial and security risks. Central regions maintain moderate readiness, characterised by partial infrastructure recovery and constrained fiscal capacity, whereas southern and eastern territories display low resilience due to infrastructure destruction, high uncertainty, and limited investor confidence.

These findings align with earlier works by Franco and Estevão (2010) and Chou and Pramudawardhani (2015), who highlighted that PPP efficiency is closely linked to institutional quality and the ability to balance risk between public and private actors. However, unlike those studies, which primarily examined PPPs in stable or transitional economies, this research focuses on wartime conditions, where investment volatility and financial uncertainty redefine the structure of partnership feasibility. This distinguishes the present study by extending the PPP evaluation framework to encompass financial risk assessment and regional investment resilience under extreme instability.

In contrast to Casady et al. (2019) and Malik and Kaur (2020), who emphasised institutional maturity and economic readiness as the core components of PPP potential, our study demonstrates that financial mechanisms and access to diversified capital sources are equally decisive. The integration of financial indicators into the multi-criteria evaluation model – alongside institutional, environmental, and social dimensions – enables a more holistic assessment of regional readiness. This addition represents a methodological advancement, situating financial sustainability and investment feasibility at the centre of PPP analysis in tourism, a dimension that has been underexplored in previous literature.

The inclusion of wartime-specific factors further differentiates this research. Studies such as Semyanchuk et al. (2023) and Krylova and Hlushchenko (2025) have discussed PPP implementation in post-crisis or high-risk contexts, yet they primarily focus on governance or institutional adaptation. In contrast, the present research incorporates financial and investment risk quantification using the Risk Priority Number (RPN) method, thereby operationalising the measurement of uncertainty in PPP feasibility assessments. This approach contributes to the development of a financially oriented risk-assessment methodology applicable to both wartime and post-conflict environments.

Moreover, while Ablaev and Akhmetshina (2016) and Mishenina and Dvorak (2022) emphasised the environmental and socio-economic dimensions of sustainable PPP projects, this study advances the discussion by demonstrating how financial mechanisms – such as concessional loans, blended finance, and green bonds – interact with regional risk structures to determine investment viability. The findings, therefore, provide new insights into how fiscal and financial resilience can shape the trajectory of tourism recovery and influence investor behaviour during periods of instability.

The theoretical contribution of this study lies in bridging the gap between financial-economic evaluation and spatial risk analysis within PPP assessment models. By integrating financial readiness indicators and investment risk assessment tools, the research expands the methodological toolkit for analysing PPP feasibility in fragile economies. This positions the study at the intersection of financial economics, regional development, and sustainable tourism management.

From a practical perspective, the results suggest that differentiated strategies are needed to maximise PPP effectiveness. Western regions can serve as pilot zones for financially innovative PPP projects – leveraging public-private co-financing and international green funds – while central regions would benefit from financial capacity-building and targeted fiscal support. Southern and eastern territories, in turn, require stabilisation of financial flows and introduction of risk-mitigation instruments, such as state-backed guarantees and insurance mechanisms, before meaningful PPP investment can occur.

Despite its strengths, the study acknowledges certain limitations. Data scarcity during wartime and reliance on expert judgement may introduce bias. Moreover, long-term macroeconomic shocks and potential shifts in international funding priorities are beyond the temporal scope of this research. However, by combining quantitative modelling with expert-based evaluation, the study provides a robust and adaptable framework for future PPP analysis in volatile contexts. Overall, this research not only confirms existing theoretical positions regarding the importance of institutional maturity and risk management but also advances the field by incorporating a financial and investment risk perspective into PPP evaluation under

wartime conditions. This contributes to academic discourse by introducing a replicable analytical model that supports evidence-based financial decision-making and strategic prioritisation of investment in sustainable tourism recovery.

CONCLUSIONS

This study has developed and applied a comprehensive methodology to assess the potential for implementing public-private partnerships in sustainable tourism across Ukrainian regions under wartime conditions, with a particular focus on financial mechanisms and investment risk assessment. The research demonstrates significant regional variation in readiness, with western regions exhibiting high PPP potential, central regions showing moderate capacity, and southern and eastern territories facing severe limitations due to infrastructure damage, fiscal stress, and security risks. The integration of economic, institutional, social, environmental, and financial indicators with risk assessment provides a robust framework for evaluating regional capabilities, vulnerabilities, and investment feasibility.

The findings confirm that institutional maturity, governance transparency, financial capacity, and resilience to socio-security threats are critical determinants of PPP effectiveness. They also emphasise the importance of integrating sound financial planning and diversified investment sources – such as budgetary funds, private capital, concessional loans, and international green finance – into PPP strategies. The research underscores that wartime conditions amplify fiscal uncertainty and investment risks, requiring adaptive mechanisms for financial risk sharing, guarantees, and blended financing.

The results highlight that strengthening local administrative and financial capacity, ensuring legal and procedural clarity, and facilitating access to domestic and international financing are key priorities for enabling PPPs to contribute meaningfully to tourism recovery. Policymakers should prioritise pilot PPP initiatives in financially stable and high-readiness regions, while directing targeted support and capacity-building measures to central regions with moderate investment potential. In southern and eastern territories, initial efforts should focus on stabilising infrastructure, restoring investor confidence, and creating preconditions for future capital inflows and partnership projects.

Emphasis on innovative financial instruments, including green bonds, impact investment funds, and digital platforms for PPP management, can enhance transparency, efficiency, and financial resilience in project implementation. The development of mechanisms for fiscal guarantees and co-financing schemes with international institutions could further improve investor confidence and project sustainability.

This study contributes a replicable methodological model for assessing PPP potential under extreme financial and security conditions, offering a decision-support tool for evidence-based financial planning, investment prioritisation, and strategic recovery management. Future research should extend the analysis to finer spatial scales and dynamic timeframes, incorporating scenario-based modelling of financial and investment risks under evolving macroeconomic and security conditions. Comparative studies with post-conflict economies could provide additional validation and international insights into best practices for PPP financing.

Moreover, further investigations into the financial acceptability of PPP projects, public trust in investment partnerships, and the role of community engagement and innovation in tourism recovery could enhance the robustness and inclusiveness of strategic planning. Overall, the research demonstrates that public-private collaboration, when guided by sound financial mechanisms and adaptive risk management, can serve as a critical instrument for sustainable tourism development and post-war economic revitalisation in Ukraine. Comparative studies with post-conflict regions in other countries could provide additional validation and insights for international best practices. Moreover, investigations into the social acceptability of PPP projects, community engagement, and the role of local innovation in tourism recovery could further enhance the robustness of strategic planning for sustainable post-war tourism development.

ADDITIONAL INFORMATION

AUTHOR CONTRIBUTIONS

All authors have contributed equally.

FUNDING

The Authors received no funding for this research.

DOI: 10.55643/fcaptp.1.66.2026.5028

CONFLICT OF INTEREST

The Authors declare that there is no conflict of interest.

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ФІНАНСОВІ МЕХАНІЗМИ ТА ОЦІНКА ІНВЕСТИЦІЙНИХ РИЗИКІВ ДЛЯ РЕАЛІЗАЦІЇ ПРИВАТНО-ПУБЛІЧНИХ ПАРТНЕРСТВ У ГАЛУЗІ СТАЛОГО ТУРИЗМУ В УМОВАХ ВІЙНИ

У дослідженні розроблено фінансово-аналітичну та ризик-орієнтовану методологічну основу для оцінювання доцільності впровадження приватно-публічного партнерства (ППП) в галузі сталого туризму України в умовах воєнного стану. Дослідження зосереджується на визначенні ефективних фінансових механізмів, інвестиційних інструментів і стратегій мінімізації ризиків, здатних забезпечити безперервність і відновлення туристичної інфраструктури в умовах фіскальних обмежень і загроз безпеці. Запропонована методика інтегрує інституційні, економічні, фінансові та соціальні показники з кількісними інструментами оцінювання ризиків, зокрема методом пріоритетного номера ризику (RPN) й багатокритеріальним оцінюванням, що дає змогу сформувати комплексний індекс фінансової та інвестиційної готовності до реалізації проєктів ППП.

Емпіричні дані отримано на основі офіційної статистики, регіональних програм розвитку й експертного опитування 112 фахівців, які представляють органи державного управління, наукові установи та бізнес-середовище. Результати дослідження свідчать про суттєву регіональну диференціацію фінансової спроможності й рівня ризику. Західні області, зокрема Львівська, Івано-Франківська та Закарпатська, характеризуються високим інвестиційним потенціалом і стійкістю (0,70–0,87); центральні регіони демонструють помірний рівень готовності (0,55–0,69), водночас південні та східні території стикаються з критичними фінансовими й безпековими обмеженнями (<0,55). Аналіз показує, що обмежений доступ до зеленого й пільгового фінансування, висока вартість капіталу та макроекономічна нестабільність є основними фінансовими ризиками, які впливають на ефективність ППП в галузі туризму.

У ході дослідження доведено, що успішність приватно-публічного партнерства в сталому туризмі залежить від інституційної зрілості, фінансових інновацій і ефективного розподілу ризиків між державним і приватним секторами. Посилення фіскальної спроможності, запровадження змішаних моделей фінансування та розширення доступу до міжнародних й інвестиційних інструментів є ключовими передумовами післявоєнного відновлення туристичної галузі України. Запропонована методологія надає політикам інструмент, який можна повторно використовувати для оцінки фінансової стійкості, визначення пріоритетності інвестиційних проєктів і розробки адаптивних механізмів ДПП, що забезпечують баланс між прибутковістю та соціально-економічними й екологічними цілями.

Ключові слова: приватно-публічне партнерство, сталий туризм, фінансові механізми, оцінювання інвестиційних ризиків, змішане фінансування, стійкість, воєнна економіка, ресурсне забезпечення, реконструкція, сценарне моделювання

JEL Класифікація: L83, O18, H54

DOI: 10.55643/fcaptp.1.66.2026.5028