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ECONOMIC RESILIENCE OF CRITICAL INFRASTRUCTURE IN UKRAINE IN THE CONTEXT OF GLOBAL FINANCIAL ARCHITECTURE TRANSFORMATION

The transformation of the global financial architecture and ongoing geopolitical instability have significantly increased the importance of resilience as a determinant of macroeconomic stability. Critical infrastructure plays a key role in ensuring the continuity of economic processes, including production, logistics, and essential services.

In Ukraine, the full-scale war has severely disrupted infrastructure sectors such as energy, transport, and telecommunications, leading to economic losses and increased systemic risk. Therefore, infrastructure resilience should be considered not only at the micro level but also as a driver of national economic stability.

Existing studies highlight the importance of resilience and risk management; however, integrated approaches combining financial, operational, and external risk factors remain limited, especially in wartime conditions.

The novelty of this study lies in the development of an integrated framework that incorporates wartime disruption factors into resilience assessment. The aim is to assess the economic resilience of critical infrastructure in Ukraine through a unified analytical model.

Economic resilience is defined as the ability of a system to absorb shocks and maintain functionality [1]. Critical infrastructure disruptions generate cascading effects affecting production and overall economic stability [4].

International studies confirm the importance of infrastructure resilience in crisis conditions [2; 3]. Modern approaches increasingly rely on data-driven methods, including machine learning techniques, which improve risk modelling in complex systems [5].

Digitalization introduces cybersecurity and regulatory risks affecting infrastructure stability [6], while cloud technologies enhance analytical capabilities [7].

However, existing research often lacks integration of operational disruption factors, which is critical in the Ukrainian wartime context.

The study applies a conceptual modelling approach integrating financial, operational, and macroeconomic dimensions within a unified framework [4]. A systems-based perspective allows capturing interdependencies within infrastructure systems.

The empirical component relies on publicly available Ukrainian and international data, normalized for comparability [8; 9].

The model includes three groups of indicators:

- financial (liquidity, profitability, stability);
- operational (continuity, disruptions, recovery);
- risk (war intensity, inflation, supply chains).

The integrated resilience index (IRI) is defined as:

$$IRI = \alpha F + \beta O + \gamma R$$

where:

IRI – integrated resilience index;

F – financial stability component;

O – operational continuity component;

R – external risk component;

α, β, γ – weighting coefficients reflecting the relative importance of each component, such that $\alpha + \beta + \gamma = 1$.

In this study, the weighting coefficients are set as $\alpha = 0.4$, $\beta = 0.4$, and $\gamma = 0.2$, reflecting the dominant role of financial stability and operational continuity in ensuring infrastructure resilience under wartime conditions, while external risks are incorporated as a moderating factor.

The components F, O, and R are independently normalized and do not necessarily sum to 1.

The index follows a linear aggregation approach ensuring interpretability.

Table 1

Indicators of economic resilience

Group	Indicator	Impact
Financial	Liquidity, profitability, stability	Positive
Operational	Continuity, disruptions, recovery	Mixed
Risk	War intensity, inflation, disruptions	Negative

Source: developed by the authors

The values represent normalized indicative estimates used to demonstrate the applicability of the model.

The results indicate that infrastructure resilience significantly affects macroeconomic stability. Disruptions lead to reduced output and increased inefficiencies.

Operational indicators play a decisive role in resilience assessment. Compared to financial-only approaches, the proposed model provides a more comprehensive system-level evaluation.

The empirical results show that telecommunications demonstrate higher resilience due to stronger operational continuity, while the energy sector remains more vulnerable. These findings are consistent with international evidence [2; 4].

Table 2

Empirical estimation of IRI (Ukraine)

Sector	F	O	R	IRI
Energy	0.45	0.40	0.25	0.39
Transport	0.50	0.45	0.30	0.44
Telecommunications	0.65	0.70	0.40	0.62

Source: authors' calculations based on [8; 9]

Conclusions. The study proposes an integrated framework for assessing the economic resilience of critical infrastructure in Ukraine. The integrated resilience index (IRI) provides a flexible tool for evaluating resilience under conditions of disruption. The framework aligns with key European Union policy instruments, including the Recovery and Resilience Facility (RRF), NextGenerationEU, and Cohesion Policy, and supports resilience-oriented investment planning.

A limitation of the study is the use of indicative empirical estimates. Future research should focus on empirical validation using real-world data and the development of real-time monitoring tools.

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