

REGIONAL INTEGRATION AND ECONOMIC SECURITY

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Abstract. This study examines the impact of regional economic integration on economic security in Uzbekistan within the context of digital transformation. The research focuses on evaluating the level of economic integration using key indicators such as economic openness, intra-industry trade, and digital integration. The findings reveal that Uzbekistan has experienced a gradual increase in economic openness, reflecting deeper participation in regional and global markets. At the same time, the results indicate that integration processes are uneven across regions, with highly integrated areas contributing more to economic growth but remaining more vulnerable to external shocks. The analysis also shows that digitalization plays a significant role in enhancing integration by improving connectivity and efficiency, while introducing new risks related to cybersecurity and technological dependence. The study highlights the dual nature of integration, emphasizing the need for balanced policies aimed at strengthening economic resilience, reducing regional disparities, and ensuring long-term economic stability in an increasingly interconnected economic environment.

Keywords: regional economic integration, economic security, digital transformation, economic openness, intra-industry trade, Uzbekistan

Introduction.

In the contemporary global economic landscape, the interconnection between regional economic integration and economic security has become increasingly significant, particularly for developing and transition economies. The intensification of globalization processes, expansion of cross-border trade, and rapid digital transformation have reshaped traditional approaches to economic cooperation, creating both new opportunities and complex challenges for national and regional stability [3]. In this context, regional economic integration is no longer limited to trade liberalization but is increasingly viewed as a strategic instrument for ensuring economic resilience, sustainability, and security [11].

For Uzbekistan, which is actively pursuing economic reforms and deeper integration into the global and regional economy, the issue of balancing integration benefits with economic security considerations is of particular relevance. The country's participation in regional cooperation frameworks, development of transport and logistics corridors, and efforts to digitalize key sectors of the economy have significantly increased its economic openness. At the same time, such openness exposes the national economy to external shocks, including fluctuations in global markets, supply chain disruptions, and geopolitical uncertainties [6]. These dynamics necessitate a comprehensive understanding of how regional integration processes influence economic security in the context of digital transformation [15].

Theoretical and empirical studies indicate that regional economic integration contributes to economic growth through enhanced resource allocation, economies of scale, and increased competitiveness. However, it may also generate asymmetric effects among participating countries, deepen structural imbalances, and create new forms of vulnerability associated with external dependencies. In particular, the growing role of digital technologies in economic integration introduces additional dimensions of risk, including cyber threats, data security concerns, and technological dependence [2]. Therefore, the relationship between integration and security should be analyzed not only from the perspective of economic efficiency but also in terms of systemic stability and risk management.



In Uzbekistan's case, the ongoing transition toward a more open and digitally driven economy requires the development of an integrated policy framework that ensures both effective participation in regional economic processes and protection of national economic interests [9]. This involves strengthening institutional capacity, improving regulatory mechanisms, and fostering innovation-driven growth while maintaining macroeconomic stability. Moreover, the alignment of national development strategies with regional integration initiatives is essential for maximizing the positive effects of integration and minimizing associated risks [13].

This study aims to examine the impact of regional economic integration on economic security in Uzbekistan within the context of digital transformation. It seeks to identify the key factors influencing this relationship, assess potential risks and opportunities, and propose policy recommendations for enhancing economic security while sustaining integration processes. By addressing the interplay between integration, digitalization, and security, the research contributes to a deeper understanding of the strategic priorities required for ensuring sustainable development (sustainable development) in an increasingly interconnected economic environment [1].

Research Methods

The methodological framework of this study is grounded in a combination of classical scientific approaches and quantitative analytical techniques, including analysis, synthesis, induction, and deduction [8]. A systems approach is employed as the principal methodological basis to examine the interrelationship between regional economic integration and economic security in Uzbekistan under conditions of digital transformation. In addition, statistical, comparative, and econometric methods are applied to ensure the robustness and consistency of the analysis.

To assess the level of regional economic integration, this study utilizes a set of indicators reflecting the openness and intensity of economic interactions [14]. The core indicator is the coefficient of overall economic openness, adapted to the context of Uzbekistan and defined as the ratio of total external and interregional trade flows to gross domestic product (GDP):

$$TO = \frac{X+M}{GDP}$$

where TO represents the level of economic openness, X denotes exports, M denotes imports, and GDP is the gross domestic product of Uzbekistan. This indicator captures the degree of integration of the national economy into regional and global markets and reflects the scale of economic interdependence.

To provide a more detailed assessment of integration processes, the study also employs the intra-industry trade index (Grubel–Lloyd index), which measures the extent of simultaneous export and import activities within the same industry:

$$GL = 1 - \frac{|X_i - M_i|}{X_i + M_i}$$

where GL is the Grubel–Lloyd index for industry i , X_i and M_i represent exports and imports of a specific product or sector. The index ranges from 0 to 1, with values closer to 1 indicating a higher level of intra-industry trade and, consequently, deeper economic integration.

In the context of digital transformation, an additional composite indicator is introduced to capture the digital dimension of integration:

$$DI = \frac{D_{exp} + D_{imp}}{GDP}$$

where DI denotes the digital integration index, D_{exp} represents exports of digital services and technologies, and D_{imp} represents imports of digital products and services. This indicator reflects the role of digital economy components in shaping modern integration processes.



The assessment of economic security is conducted through a set of indicators reflecting vulnerability and resilience of the national economy. These include trade dependency ratios, diversification indices, and external shock sensitivity coefficients. In particular, the trade dependency ratio is calculated as:

$$TD = \frac{X+M}{GDP}$$

which allows identifying the degree of exposure of the economy to external risks.

To identify structural patterns and heterogeneity in integration levels, cluster analysis is applied using k-means and hierarchical methods. This enables grouping economic sectors based on their degree of openness, digitalization, and contribution to economic security [5]. The clustering procedure is supported by statistical software and is based on normalized indicator values.

The empirical base of the study consists of official data from national statistical agencies of Uzbekistan, international databases (World Bank, UNCTAD), and digital economy indicators. The data are processed using statistical transformation techniques to ensure comparability and consistency across indicators [12].

Results and Discussion

The empirical assessment of regional economic integration and its implications for economic security in Uzbekistan was conducted through a structured analytical procedure based on the indicators and methods outlined in the previous section. The evaluation process was organized as a systematic multi-stage framework, enabling the identification of both integration dynamics and potential economic security risks.

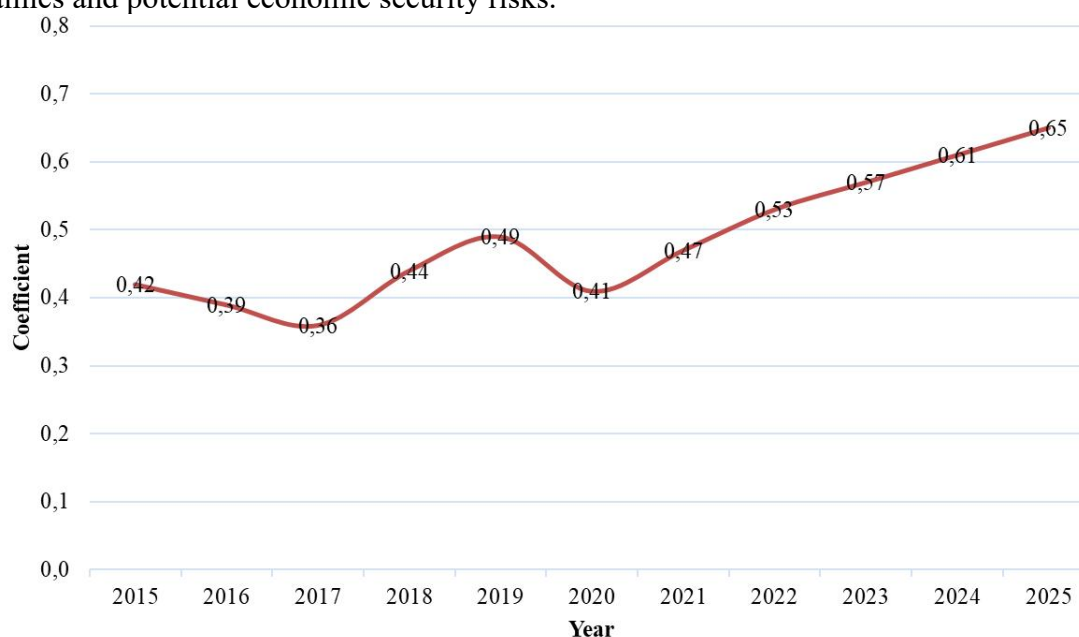


Figure 1. Dynamics of the Coefficient of Uzbekistan's overall economic openness.

At the initial stage, statistical data on Uzbekistan's foreign trade turnover, sectoral exports and imports, and digital economy indicators were collected and systematized. Based on these data, the coefficient of economic openness was calculated, reflecting the degree of the country's integration into regional and global markets. The results indicate a gradual increase in Uzbekistan's economic openness over the observed period, largely driven by trade liberalization policies, expansion of export-oriented production, and growing participation in regional cooperation initiatives.



At the same time, the dynamics of this indicator exhibit a non-linear pattern. Periods of increasing openness are associated with higher external trade activity and investment inflows, while fluctuations reveal sensitivity to external shocks, including global market instability and supply chain disruptions [4]. This confirms that deeper integration not only enhances economic opportunities but also increases exposure to external risks.

Table 1. Dynamics of Regional economic integration clusters in Uzbekistan

Cluster	Number of regions										
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
1	2	3	3	4	4	3	4	5	5	6	6
2	4	4	5	5	5	4	5	5	5	5	5
3	8	7	6	5	5	7	5	4	4	3	3

**Note.* Compiled by the author based on data from the Statistics Agency under the President of the Republic of Uzbekistan, World Bank, and IMF (2015–2024); 2025 — author’s forecast.

Cluster 1: High level of economic integration (Tashkent city, Tashkent region, Fergana region).

Cluster 2: Medium level (Samarkand, Namangan, Andijan, Bukhara, Navoi regions).

Cluster 3: Low level (Kashkadarya, Surkhandarya, Jizzakh, Syrdarya, Khorezm regions, Republic of Karakalpakstan)

Further analysis based on the Grubel–Lloyd index demonstrates a moderate but steadily increasing level of intra-industry trade in sectors such as manufacturing and agro-processing. This reflects a gradual shift from simple inter-industry exchange toward more complex and diversified trade structures, which is a characteristic feature of deeper economic integration. However, relatively low index values in high-technology sectors indicate structural constraints in integrating into advanced global value chains [10].

To examine structural differences in integration levels, cluster analysis was applied using normalized indicators of economic openness, digital integration, and trade diversification. The results made it possible to group economic sectors into three main clusters:

- The first cluster includes highly integrated sectors characterized by strong export performance, active participation in regional trade networks, and higher levels of digitalization. These sectors contribute significantly to economic growth but are more vulnerable to external fluctuations.

- The second cluster consists of moderately integrated sectors, where domestic and external interactions are relatively balanced. These sectors show stable development patterns and play an important role in maintaining economic stability.

- The third cluster comprises low-integration sectors with limited involvement in regional economic processes. While these sectors are less exposed to external risks, they also demonstrate lower growth potential and limited contribution to overall economic security.

The clustering results highlight the uneven distribution of integration across sectors of Uzbekistan’s economy. A substantial portion of economic activity remains concentrated in moderately and weakly integrated sectors, indicating the presence of significant potential for further integration and development [7].

In addition, the analysis of digital integration indicators shows an increasing role of digital technologies and services in shaping integration processes. The expansion of digital trade, electronic commerce, and information and communication technologies has improved market access and reduced transaction costs. At the same time, new risks have emerged, including



technological dependence, cybersecurity challenges, and gaps in digital infrastructure development.

These results suggest that strengthening economic security in the context of ongoing integration requires a balanced and sector-specific approach that takes into account structural differences, digital transformation, and evolving global economic conditions.

Conclusion.

The findings of this study demonstrate that regional economic integration in Uzbekistan has intensified over the observed period, as reflected in the steady growth of economic openness and the gradual expansion of intra-industry trade. The results reveal a differentiated structure of integration across regions, where highly integrated areas contribute significantly to economic growth but remain more exposed to external risks, while less integrated regions exhibit lower vulnerability but limited development potential. At the same time, the increasing role of digital technologies has accelerated integration processes, improving efficiency and connectivity while simultaneously generating new challenges related to technological dependence and cybersecurity.

The relationship between regional economic integration and economic security is inherently dual in nature. Integration supports economic diversification, competitiveness, and long-term development, yet it also increases exposure to external shocks and structural imbalances. Ensuring economic security in Uzbekistan therefore requires a balanced and adaptive policy approach focused on strengthening institutional capacity, enhancing digital resilience, and reducing regional disparities. Such measures will allow the country to maximize the benefits of integration while effectively managing associated risks in an increasingly interconnected economic environment.

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