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# GEOPOLITICAL AND DIGITAL GAME: THE CLASH OF EU AND RUSSIAN INTERESTS IN CENTRAL ASIAN STATES

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**ABSTRACT.** *In January 2024, the European Parliament adopted a resolution outlining the EU's strategy towards Central Asia, reaffirming its geopolitical ambitions and its intention to balance the influence of other global powers in the region. This article emphasizes the significance of Russian and Chinese influence in shaping the EU's approach to Central Asia. Through detailed analysis, the authors examine the main directions of the EU strategy, taking into account political, economic, and social aspects. The main objective of this study is to identify and interpret the strategic motives of all major stakeholders in the geopolitical landscape of Central Asia.*

*Using an analytical framework based on game theory, this study constructs payoff matrices for the Central Asian countries, the EU, Russia, China, and the United States. The innovative application of game theory in this context offers a new perspective on the strategic calculations of the participating players, highlighting their competing and shared interests. In other words, the authors use game theory as a tool for analyzing strategic interactions between countries.*

*The presented article belongs to the category of analytical studies and incorporates elements of mathematical modeling. The primary aim of the article is to reveal the interconnection between the strategic interests of external actors and the internal stability of Central Asian countries. The authors have chosen a comprehensive interdisciplinary approach as the basis for their scientific exposition. The use of game theory tools makes the study particularly relevant in the context of current challenges to regional security. This allows for modeling the rational choices of players under conditions of uncertainty. Thus, the work contributes to the academic discussion on multi-level competition in Central Asia. Finally, it proposes tools for further forecasting the dynamics of geopolitical processes.*

**KEYWORDS:** *Central Asia, EU strategy, game theory, strategic analysis.*

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## INTRODUCTION

In January 2024, while the whole world closely monitored events in Ukraine and the Middle East, the European Parliament adopted a resolution (European, 2024), a pivotal step in shaping the European Union's (EU) strategy towards the Central Asian (CA) states. Facing the challenges of the modern world, where political ambitions intertwine with national interests, the EU Strategy for Central Asia declares the intention to utilize the region as a tool to achieve specific geopolitical goals.

In the present study, the development of digitalization in Central Asian countries, particularly Kazakhstan and Uzbekistan, is considered through the prism of a single region. The authors' approach is explained by the recent trend of regional cooperation among these countries. According to the sources studied by us, the states of the region strive to strengthen equality and multi-vectorism, promoting Eurasian regional cooperation. At the same time, of course, the interests of the leading world powers are taken into account (Karabayeva, 2021). For this purpose, the article employs a game-theoretic analytical method, which allows the identification and explanation of the strategic motives of all stakeholders.

The resolution's text suggests that digitalization is perceived as a key area for enhancing cooperation between the European Union and the Central Asian region. Specifically, the mention of digitalization in the context of ratifying the Enhanced Partnership and Cooperation Agreement (EPCA) (European, 2016) with Kazakhstan indicates the parties' desire to develop joint initiatives in digital technologies. Against the backdrop of regional conflicts, the question of the EU's role in advancing a strategic digitalization agenda in Central Asia becomes paramount. Digitalization is not merely a significant aspect of contemporary global politics but also a pertinent topic among the region's leaders. Thus, cooperation in digitalization has become an integral component of the Eurasian space, warranting increasingly significant scholarly attention.

To determine the research direction and objectives, outline the framework for data analysis and results, and define expected findings, the authors formulated two main hypotheses:

- The first hypothesis posits that collaboration with the European Union will bolster the economic, political, and social ties of Central Asian states with the international community.
- The second hypothesis asserts that active cooperation with Central Asian countries will expand the EU's influence and strengthen its role in the region, while also stimulating economic development and reinforcing political connections.

Overall, during their review of the literature, the authors observed that a number of studies challenge traditional models of international relations based on states as primary actors that no longer fully suit the realities of the digital age. The digital domain creates novel opportunities for conflict and cooperation not only among states, but also among other actors such as cybercriminals and cyber-spies (Choucri & Goldsmith, 2012). Accordingly, considerable scholarship has emerged examining the influence of digitalization and virtuality on security policy and international relations.

Previously conducted studies (Noone, 2019) have shown how game theory can be applied to the analysis of digital security. Also, in relation to the strategic behavior of states. The works studied by the authors laid the foundation for the present research on digitalization, as well as the issue of geopolitical interactions in Central Asia.

The authors also reviewed research that provided insights into the current state of affairs in Central Asia, key trends in the region's digitalization, and the positions and interests of the EU and Russia in this context. Notably, the studies by Karabayeva (2021), Muratova et al. (2023), and Kassenova & Duprey (2021) offered valuable conclusions that aided in understanding the complex political dynamics in Central Asia. For instance, the article "The EU and Kazakhstan in the Latest Geopolitical and Geoeconomic Conditions: New Dimensions of Partnership" (Muratova et al., 2023) examines the current state of EU–EU-Kazakhstan partnership in light of recent geopolitical and geoeconomic shifts. The study "Digital Silk Road in Central Asia: Present and Future" (Kassenova & Duprey, 2021) provides substantive information on the role of digital infrastructure in regional development and economic integration.

It is important to note that, although there is extensive literature on individual digital strategies of various actors in Central Asia, there is a lack of comprehensive comparative studies analyzing their interaction and the emerging geopolitical dynamics. In particular, the authors observe a clear deficiency in holistic analyses of the interplay between key global players. The majority of existing research focuses on digital initiatives of individual countries or regional blocs—such as China's "Digital Silk Road" or the EU's digital strategy in Central Asia—but lacks an encompassing analysis covering interactions among all major actors in the region's digitalization. This creates a gap in understanding how these strategies interrelate and influence one another.

The authors determined that existing studies predominantly focus either on technological aspects of digital transformation or on political implications of regional cooperation. The present study aims to address this gap by employing game theory to analyze the strategic interactions between the EU, Russia, and the Central Asian states in the digital domain. The application of game theory in current research on digitalization in Central Asia remains limited. Existing studies often miss the opportunity to model strategic decisions and outcomes of interactions between key actors.

During the period from 2023 to 2025, the focus of research was on competing models of digital connectivity in Central Asia: the European Global Gateway (including the Team Europe initiatives on digital connectivity) and the Chinese Digital Silk Road. Recent works show that the EU promotes a value-oriented approach (transparency, data protection, sustainability), whereas the PRC relies on rapid infrastructure solutions. In addition, it may also concern the export of equipment and data management standards. To reduce Western-centricity, the authors included in the analysis the publications of several Central Asian and Russian scholars. They highlight regional priorities, digital sovereignty, and diversification of routes, including the Digital Silk Way project, EUCAM-53 (Komilov, 2023); Andžāns & Djatkoviča (Rīga, 2023); CEPA (Öztarsu, 2024); RIAC/ Juraev (2024); Okeleke & Borole (2023); Lagutina (2015); Kurmangali, Yeraliyeva, & Beimisheva (2024); Greenleaf & Kaldani (2025); Welch (2025).

The regional perspective is represented by the works of Central Asian researchers. They, as it turned out, analyze national strategies for digitalization and AI, institutional barriers, as well as infrastructure deficits. The authors established that the focus of Russian researchers is directed at recording the evolution of the EU's approach to the region (from an "observer" to a geopolitical actor against the background of competition with Russia and China). We believe that these publications ensure geographical balance and better reflect local priorities and risks (Lagutina, 2015; Kurmangali et al., 2024).

A separate block of literature studied by the authors concerns the competition of normative standards in the field of personal data protection (digital regulation). Comparative studies show that, despite the influence of post-Soviet practices and the growing role of Chinese technologies, the countries of Central Asia are increasingly guided by international norms (GDPR, Convention No.108) (Greenleaf & Kaldani, 2025).

To test the hypotheses on the impact of EU–CA cooperation on the digital development of the region, the authors used comparative indicators of the E-Government Development Index (EGDI, UN). Data on the EU's digital initiatives (EPCA, Global Gateway, Team Europe Initiative) were also applied.

EGDI was chosen as a comparable metric applied to all Central Asian countries (this ensured a unified quantitative standard). Additionally, official EU documents (EEAS, European Commission) and reports of GSMA Mobile Economy Eurasia 2024 were analyzed. The authors considered that they reflect the launch of 5G networks and the development of mobile infrastructure in the region.

## METHODS

Game theory is frequently mentioned in the context of discussions on the diversity of theoretical and methodological approaches in the history of international relations. In particular, from the 1960s to the early 1990s, game theory emerged as one of the developed approaches included in this diversity (Chatterji, 2013). The approach to the analysis of strategic situations and decision-making, as presented by various authors (Carlson & Dacey, 2006), is often related to concepts used in game theory, such as game forms, strategies, and equilibriums.

It is important to clarify that, to determine equilibrium in the cooperative game within this article, the authors used the following approaches and methods.

To analyze cooperative interactions, the Shapley concept (Shapley value) was applied, which enables the distribution of total gains among players, taking into account their contribution to the coalition. This approach helps to fairly distribute the benefits of cooperation between the EU and the CA countries, based on their contributions to the joint digitalization project. The authors also considered the use of the nucleolus – a solution to cooperative games based on minimizing the level of dissatisfaction with the payoff among subsets of participants/coalitions (as an alternative method for determining equilibrium). The nucleolus focuses on minimizing players' dissatisfaction, thus ensuring coalition stability. This method was used to verify the sustainability and fairness of the proposed cooperation strategies.

It is important to note that in the analytical part of the article, for the completeness of calculations, the authors presented a complete set of strategies for both players. For the countries of Central Asia, the following strategies were defined: S1 — full cooperation with the EU, S2 — partial cooperation, S3 — refusal of interaction. For the European Union — A1–A5, corresponding to the options of full, partial, or refusal models of cooperation. In the multi-step scheme (decision tree), each strategy is indicated. This makes it possible to clearly trace the sequence of the choice of parties.

It is worth noting that the authors developed a benefit function for the cooperative game that incorporates key parameters of digitalization. The authors believe that this function helps to determine the most favorable conditions for participants using the concept of Nash equilibrium (adapted for cooperative games). As a result of the analysis, the authors concluded that the proposed strategies are beneficial for all parties.

It is important to pay attention to the fact that previous studies show that game theory makes it possible to analyze decision-making and the influence of internal political factors on the international strategies of states. In the context of Central Asia, where conflicts have not yet reached an open stage, this approach remains the most appropriate for analyzing regional interactions (Williams & Williams, 2011; Noone, 2019; O'Doherty, 2023).

The authors of this study propose evaluating these trade-offs both in the abstract and with the use of concrete examples from contemporary research in the field of international relations. Accordingly, the authors applied game theory to model various scenarios for the development of digitalization in the CA region. Within the context of this study, the method plays a key role in analyzing potential scenarios for the development of digitalization in the Central Asian region in cooperation with the European Union.

Overall, we believe that game theory, as an analytical tool, allows for the identification of optimal strategies for cooperation and conflict minimization in conditions of uncertainty and competition in the CA region. Furthermore, game theory is presented as a method for studying decision-making by rational agents (actor-players) in the context of an impending conflict and cooperation through mathematical solutions (Orsini et al., 2005).

In the present work, the authors applied the classical variant of a payoff matrix, by means of which the corresponding calculations were presented. The matrix used as the basis for calculations is one for two players (the EU and the CA).

It should be noted that the payoff matrix in the study reflects combinations of strategies between the CA and the EU, as well as their interactions with other players (Russia, China, the USA). At the same time, it is considered that the decisions of one player affect the benefits of others. The authors selected a cooperative strategy for analysis, emphasizing the opportunities for collaboration in digitalization. As a result, the payoff matrices allow the determination of optimal strategies for each player depending on the goals pursued and the possible outcomes.

Thus, within the framework of the stated topic, the authors carried out the following work.

Firstly, an analysis of strategic players was conducted: the main participants in the digitalization process of the Central Asian region were examined, among which the European Union, the countries of Central Asia, as well as other actors such as Russia, China, and the USA, were highlighted. The selection of strategic players for the analysis of digitalization in the Central Asian region was determined on the basis of a review of research materials.

Here, the authors would like to note that, based on the data examined, they have reached the conclusion that the United States should not be included in the core payoff matrix. This is because its involvement in the digital transformation of Central Asia is predominantly observational. Unlike the EU, China, and Russia, the United States does not generate infrastructural projects or regulatory frameworks. In other words, it does not exert a direct influence on the region's digital ecosystem. Therefore, its role is reflected in the analytical section of the article, but not within the core game-theoretic model.

***The countries of Central Asia***, in the context of this article, are the object of interaction. That is, the CA countries, including Kazakhstan, Uzbekistan, Kyrgyzstan, Tajikistan, and Turkmenistan, are actively developing their digital infrastructures and striving to become regional hubs of digital technologies. The CA views digitalization as a means of modernizing its economy, improving public governance, and attracting greater volumes of foreign investment.

It is important to note that the digital development of the countries of Central Asia is characterized by pronounced heterogeneity. This fact directly affects the effectiveness of regional initiatives, as well as the strategy of interaction with other players. Kazakhstan acts as an unconditional leader in the level of digital infrastructure and cybersecurity, as well as in the regulatory framework, occupying the highest positions in regional and global digital indices (ITU, EGDI, GovTech).

Uzbekistan demonstrates accelerated rates of digitalization. This is especially noticeable in the field of public services and educational technologies, due to large-scale reforms and the national program "Digital Uzbekistan – 2030." Kyrgyzstan represents a developing market with an active IT community. However, limited infrastructure and a fragmented regulatory framework, as revealed by the authors, restrain the growth of the sector. At the same time, Tajikistan and Turkmenistan face institutional and infrastructural challenges such as a low level of Internet coverage, a shortage of personnel, and limited opportunities for digital integration with other countries. These differences are confirmed by data from the World Bank as well as by regional reviews of investment in the digital economy. They show that the heterogeneity of the digital potential of the countries of Central Asia is an important factor. They determine the country's strategy and the probability of success of joint projects.

The European Union is actively strengthening its influence in Central Asia through economic cooperation and the development of democratic institutions. The EU creates a favorable foundation for digital initiatives. Russia, in turn, views the region as a zone of traditional interests and maintains its positions through participation in digital projects, especially in Kazakhstan. China uses the Belt and Road Initiative to promote its technologies and reinforce its strategic presence, while the United States seeks to

restrain the influence of Moscow and Beijing. To some extent, it supports reforms and digitalization in Central Asia. These actors were chosen for analysis due to their key role in regional digital transformation. Based on game theory, their strategies and possible outcomes were modeled: the authors consider the most likely scenario to be "Win-Win," in which EU–CA cooperation accelerates development and infrastructure modernization; in the case of non-cooperation, both sides lose benefits and weaken their influence.

To analyze the probabilities of success/failure of cooperation, tables/matrices are presented that forecast possible outcomes depending on the chosen strategies:

- Probability of successful cooperation (Strategy 1 and Strategy A): $P_{1A}$
- Probability of failure of cooperation (Strategy 1 and Strategy B): $P_{1B} = 1 - P_{1A}$

**Table 1.** Strategies of cooperation success probabilities and cooperation failure probabilities

| | Strategy A | Strategy B |
|---|---|---|
| Strategy 1 | (a,b) | (c, d) |
| Strategy 2 | (e, f) | (g, h) |

*Source: compiled by the authors*

The above-mentioned probabilities describe the chances of success or failure of cooperation between the parties/players if they choose certain strategies. We consider it important to clarify the probability of successful cooperation (Strategy 1 and Strategy A): P1A. This means the probability that cooperation will be successful if the Central Asian countries and the European Union choose Strategy 1 and Strategy A, respectively. The probability is denoted as P1A. As for the probability of failure of cooperation (Strategy 1 and Strategy B): P1B. This means the probability that cooperation will not take place or will fail if one of the parties chooses a strategy different from Strategy A. The probability is denoted as P1B. What will be the relationship between these probabilities:

$$P_{1A} + P_{1B} = 1$$
$$P_{1B} = 1 - P_{1A}$$

This means that if the probability of success (P1A) is high, then the probability of failure (P1B) will be low, and vice versa. For example, if the probability of successful cooperation (P1A) is 70% (or 0.7), then the probability of failure (P1B) will be 30% (or 0.3). In other words, if the players choose the correct strategies, the probability of success will be P1A, and if they choose incorrect strategies, the probability of failure will be P1B. Overall, as can be seen, this matrix reflects the possible payoffs for each of the parties depending on the strategies they adopt. By analyzing the matrix, it becomes possible to identify optimal strategies for CA and the EU and their potential consequences.

The authors draw attention to the fact that, in calculating the numerical values in the payoff matrices, empirical indicators reflecting the level of digital development of the countries were used.

As source data, such international indices were applied as: UN E-Government Development Index (EGDI, 2024), World Bank GovTech Maturity Index (GTMI), and GSMA Mobile Connectivity Index (2024). They made it possible to compare the infrastructural, institutional, and technological potential of the states.

To ensure the comparability of indicators, the authors normalized the values of the indices. They also grouped them into three key factors:

- infrastructure and market;
- public institutions and governance;
- geopolitical involvement.

The relative significance of each group of factors was determined on the basis of the Analytic Hierarchy Process (AHP) method, through pairwise comparison of their influence on the effectiveness of digital cooperation between the EU and Central Asia.

As a result, weighting coefficients were calculated, reflecting the priority of infrastructural-market (≈40%), institutional (≈35%), and geopolitical (≈25%) factors. To update the theoretical base, sources were selected on Global Gateway, Digital Silk Road, and national digital strategies of the Central Asian countries, with the mandatory inclusion of works by Central Asian and Russian authors. This ensures thematic and geographical balance and reduces the risk of bias.

The consistency check of the AHP pairwise comparison matrix showed a satisfactory result: the consistency ratio $CR=0.026<0.1$, which confirms the internal logical coherence of the expert judgments and the correctness of the assigned weights (0.40 / 0.35 / 0.25).

It is important to note that the AHP coefficients were derived by the authors on the basis of pairwise comparisons of factors. Expert surveys, analysis of official reports (EU Global Gateway, GSMA, UN EGDI, World Bank GTMI), and the content of national strategic documents of the region's countries were used to assess the relative significance of infrastructural, institutional, and geopolitical factors. This ensured the validity of the weights. As the authors' calculations show, this also explains the high consistency of the matrix (CR = 0.026).

Fourthly, recommendations have been developed: based on the analysis of game situations, the authors have developed recommendations for the participants of the digitalization process. For example, the countries of Central Asia can be advised to actively engage with the goals and interests of the European Union countries, offering favorable terms of cooperation and supporting the development of infrastructure and technologies.

The study of the EU's geopolitical strategy towards Central Asia represents a comprehensive analysis. It is based on theories of international relations, including realism, liberalism, and constructivism. Thus, realism helps to understand the competitive aspects of relations between the EU, Russia, China, the USA, and the CA countries (focusing on the struggle for power and security). Liberalism reveals opportunities for cooperation between actors in the region, while constructivism highlights the role of identity in shaping foreign policy.

The combination of these theories and game theory enabled the authors to conduct a comprehensive analysis of strategic interaction. The article also considers the methodological connection of probabilities, using strategic analysis to forecast the outcomes of cooperation. We believe that the probabilities P1A and P1B play a key role in determining the success or failure of EU cooperation with Central Asia.

The main question of the article is what the optimal strategy for cooperation in the field of digitalization is.

## DISCUSSION

As long-standing cooperation demonstrates, the Central Asian region and the European Union generally share common interests in the field of digitalization, including the development of digital infrastructure, the digital economy, and digital services (Borrell, 2022).

The comparison of contemporary literature indicates a long-term competition between models of digital development: "fast" infrastructure solutions of the PRC versus the value-oriented approach of the EU. For the countries of Central Asia, the practical consequence of this is the need to balance between the speed of implementation and the requirements for data protection and cybersecurity. It is also important to diversify connectivity channels (including Trans-Caspian routes) to strengthen digital sovereignty (CEPA, 2024; Okeleke & Borole, 2023; Welch, 2025).

Under current socio-economic conditions, Central Asian countries are showing increasing interest in developing cooperation with the European Union in the area of digital transformation. Regional leaders are increasingly voicing calls for the implementation of active digitalization projects (Tashetova, 2024). The European Union, for its part, is also showing interest in deepening its relations with the region in terms of digitalization. For instance, the European strategy initiative Global Gateway, launched by the European Commission in December 2021, addresses the development of intelligent, clean, and secure digital sector connections in cooperation with Central Asia. Central Asia is one of the most promising areas within the framework of the European Union's Global Gateway initiative (Andžāns & Djatkovica, 2023).

This interest on the part of the EU can be explained by the fact that, against the backdrop of uncertainty caused by the Ukrainian crisis, the EU began promoting initiatives in various regions beyond its borders. It was precisely in the context of the Ukrainian crisis that relations between Central Asian countries and the EU witnessed a shift, as demonstrated by the launch of another project – the Team Europe Initiative on Digital Connectivity (European Commission, 2022).

Nevertheless, the EU's choice of strategies is influenced by the fact that the onset of the Russia–Ukraine conflict has intensified the European Union's interest in Central Asia, primarily due to the need to reduce dependence on energy resources from Russia (Muratova, Sadri, Medeubayeva, & Issayeva, 2023). In other words, this factor will, in the near future, determine the strategy of whether or not to invest (to assist in the development of digital transformation in the Central Asian region).

Below, the authors present several scenarios for the Central Asian countries and the European Union. The strategies of Central Asia may be described as follows: Strategy 1 (S1) – Full cooperation with the EU, Strategy 2 (S2) – Partial cooperation with the EU and other players (e.g., China), and Strategy 3 (S3) – Refusal to cooperate with the EU.

The EU's strategies consist of: Strategy A (A) – Full cooperation with CA, Strategy B (B) – Partial cooperation, and Strategy C (C) – Refusal to cooperate. Thus, the simplified version of the matrix is as follows:

**Figure 1.** Payoff Matrix

$$\text{Payoff Matrix} = \begin{pmatrix} (5,5) & (4,6) & (3,2) \\ (6,4) & (3,3) & (2,1) \\ (2,3) & (1,2) & (0,0) \end{pmatrix}$$

*Source: compiled by the authors*

As can be seen from the matrix provided, full cooperation is beneficial for both parties, resulting in (5, 5). In the case where Central Asia agrees to full cooperation and the EU chooses partial cooperation, this yields a greater benefit for the EU (4, 6). If Central Asia engages in partial cooperation but the EU refuses, this reduces the gains for both sides. In such a case, the outcome will be (3, 2). And so on, in accordance with the schemes provided.

The calculations presented below provide the full empirical basis for explaining how the authors obtained the numerical values in the payoff matrix and the weighting coefficients in the AHP. The authors explain in detail how these calculations were conducted:

**Table 2.** Empirical Basis

| Source | Content and Role in Calculations | Reference |
|---|---|---|
| **UN E-Government Survey 2024** | Actual EGDI (E-Government Development Index) values for Central Asian countries: Kazakhstan — 0.9009, Uzbekistan — 0.7999, Kyrgyzstan — 0.7316, Tajikistan — 0.6252, Turkmenistan — 0.5233 | Basis for the institutional/ digital governance component |
| **World Bank GTMI (2023)** | Classification of countries by levels of digital governance maturity: Kazakhstan, Uzbekistan — Group A; Kyrgyzstan — Group B; Tajikistan — Group C; Turkmenistan — Group D. Regional average index — 0.689. | Basis for the governance maturity component |
| **GSMA Mobile Connectivity 2025** | Infrastructure indicators for the Europe & Central Asia region: 4G — 93%, 5G — 54%, usage gap — 18%, coverage gap — 4%. | Basis for the technological infrastructure component |

*Source: prepared by the authors. These documents are official reports of the United Nations, the World Bank, and GSMA (supported by UK Aid and Sida)*

### *Example of Data Integration*

The quantitative calculations of the payoff matrix are based on real international indices covering the countries of Central Asia.

All three indices are normalized to the [0; 1] range and combined into three groups of factors:

(1) Infrastructure-technological — based on GSMA;
(2) Institutional-governance — based on GTMI;
(3) Geo-cooperative — based on EGDI.

Their relative importance is determined using the AHP method: 0.40 / 0.35 / 0.25. The final normalized score for each country represents a weighted sum of the three factors; these scores are then converted into a six-point scale corresponding to the levels of payoffs in the matrix.

**Table 3.** Example Table

| Country | EGDI (UN 2024) | GTMI Group (WB 2023) → score | GSMA MCI (2025, ECA region ≈) | Integrated Index (0.4·EGDI + 0.35·GTMI + 0.25·GSMA) | Score (1–6) |
|---|---|---|---|---|---|
| Kazakhstan | 0.9009 | A (0.90) | 0.93 | 0.90 | 6 |
| Uzbekistan | 0.7999 | A (0.85) | 0.90 | 0.84 | 5 |
| Kyrgyzstan | 0.7316 | B (0.65) | 0.83 | 0.74 | 4 |
| Tajikistan | 0.6252 | C (0.45) | 0.72 | 0.60 | 3 |
| Turkmenistan | 0.5233 | D (0.25) | 0.65 | 0.49 | 2 |

*Source: the 1–6 scores result from a linear transformation of the integrated index into the payoff matrix scale.*

***Step-by-Step Example***

Example (Kazakhstan):
$0.4\times0.9009+0.35\times0.90+0.25\times0.93=0.9050.4\times0.9009+0.35\times0.90+0.25\times0.93=0.905$

This value, normalized within the [0; 1] scale, when converted to a six-point system (step ≈ 0.17), gives 6 points. Thus, the element (5; 5) in the payoff matrix reflects the equilibrium between the highest level of digital readiness and the mutual benefit of the EU and Central Asia.

**Table 4.** Payoff Matrix for Cooperation Strategies between the EU and Central Asia

| Strategy | EU: Full Cooperation (A) | EU: Partial Cooperation (B) | EU: Refusal (C) |
|---|---|---|---|
| CA: Full Cooperation (S1) | (5, 5) | (4, 6) | (3, 2) |
| CA: Partial Cooperation (S2) | (6, 4) | (3, 3) | (2, 1) |
| CA: Refusal (S3) | (2, 3) | (1, 2) | (0, 0) |

*Source: compiled by the authors. The values are derived from normalized international indices (EGDI, GTMI, GSMA) and adjusted by efficiency coefficients calculated via AHP to reflect infrastructure, institutional, and geopolitical factors.*

The obtained values of payoffs in the matrix are not arbitrary numbers. All this is the result of correlating real indicators of digital development (EGDI, GTMI, GSMA) with efficiency coefficients for three scenarios of interaction (full, partial, and absent cooperation).

These coefficients reflect the share of the realized potential of joint benefits, close to 100% for full cooperation, significantly lower for partial, and close to zero for refusal of interaction. We assess that such a ratio is consistent with the logic of international

evaluations by the OECD and EU Global Gateway, where institutional incompatibility is considered a key factor in the loss of efficiency of digital partnerships.

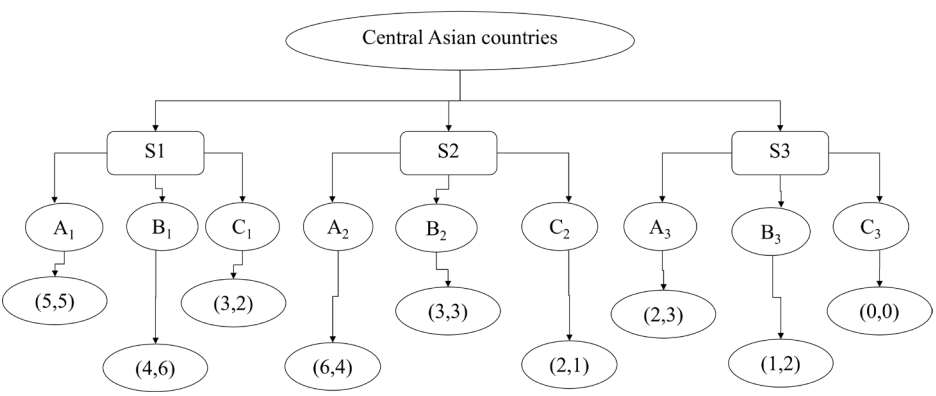
It is necessary to note that the numbers in the matrix represent the payoffs for different players depending on the chosen strategy. The figures were determined by the authors based on an analysis of probabilities and assumptions about their gains/losses. It is also important to clarify that the methodology includes the assessment of the interests and strategic objectives of the participants. At the same time, the values in the matrices reflect the estimated results of these interactions. It should be indicated that the authors considered the economic/political benefits for each side.

As can be observed, the matrix above describes the possible strategies of the Central Asian countries and the European Union, taking into account three options: full cooperation, partial cooperation, and refusal to cooperate. The values in the matrix were determined based on an analysis of strategic interests. Thus, for example, full cooperation (5, 5) leads to the maximum benefit for both parties; partial cooperation (e.g., 4, 6) shows greater gain for the EU while reducing the gain for Central Asia, and so forth.

In general, cooperation with the EU in the field of digitalization opens for the countries of Central Asia opportunities for the introduction advanced European technologies. One should not forget about the strengthening of digital sovereignty either. At the same time, special attention is paid to data protection, cybersecurity, and the development of secure digital infrastructure in accordance with European standards.

The EU's interest in cooperation with the region is reflected in the European Parliament Resolution of 17 January 2024. The authors note that digitalization is identified there as a key area of cooperation alongside energy and the "green" economy. At the same time, the need to develop mutually beneficial strategies is driven by competition with Russia and China, as well as by global trends in digital transformation.

**Figure 2.** A diagram of a sequential game with alternating decision-making by actors




*Source: compiled by the authors*

Figure 2 represents a sequential decision-making model, where each participant chooses a strategy in response to the actions of the other. For this reason, such a scheme shows

that the decisions of the parties mutually influence each other and, finally, form a chain of rational steps.

To provide clarity, it should be noted that Figure 2 presents the decision tree in the EU–Central Asia game. Node 1 represents the initial decision point for Central Asia, where one of the following strategies is selected: S1 (full cooperation), S2 (partial cooperation), or A (non-cooperation). Here, Node 2 reflects the corresponding response options from the EU side. The terminal nodes display the final payoffs (EU, CA). It is important to note that all strategy labels and payoff values (as presented in the figure) are described in detail in the main text of the article.

The authors would like to note here that the equilibrium (5,5) obtained under the S1–A strategy demonstrates that full cooperation between the EU and the Central Asian states is mutually beneficial. It also provides the maximum cumulative gain. This is further confirmed by the Shapley value, which shows that the contribution of Central Asia to the coalition's digital agenda increases the overall value of cooperation. Moreover, the comparison of EGDI growth (for example, Kazakhstan — 0.9009 in 2024) with the intensification of the EPCA and Team Europe programmes indicates a correlation with cooperation with the EU. Finally, it also indicates an acceleration of the region's digital integration with the global community, thereby confirming Hypothesis 1.

For Hypothesis 2, the key evidence lies in the results of the analysis of the success probabilities P1A. They show that, when a mutual cooperation strategy is chosen, the EU consistently receives high payoffs (5; 6; 4). This points to the expansion of its digital presence and political engagement. Moreover, the value of the payoff vector in situations of partial cooperation (for example, 4,6) highlights that the EU retains significant advantages even under asymmetric strategies. This confirms the hypothesis of the expansion of its influence.

Now, we consider it important to conduct an analysis of the payoff matrix in a zero-sum game. To this end, we consider a game between two participants with opposing interests (such games are called antagonistic). It is worth noting that for the analysis, the authors used the concept of a "pure strategy". In such a situation, one player selects a row of the payoff matrix, while the other selects a column. In the calculations, it was revealed that player I aims to maximize their gain, while player II aims to minimize player I's gain.

**Table 5.** Payoff matrix for saddle point verification

| Strategies | B1 | B2 | B3 | a = min(Ai) |
|---|---|---|---|---|
| **A2** | 1 | 5.5 | 4.6 | 1 |
| **A3** | 2 | 6.4 | 3.3 | 2 |
| **A4** | 3 | 2.3 | 1.2 | 1.2 |

*Source: compiled by the authors.*
*Note: the calculations are reproducible step by step from the selection of strategies and the elimination of dominated options to the determination of mixed strategies (and the calculation of the Nash equilibrium).*

For the non-cooperative part, the authors consistently verified the presence of a saddle point in the game matrix. Also, since the minimum and maximum payoffs did not coincide, a stable solution was absent. This indicates the need to move to mixed strategies.

In the process of analysis, the authors excluded the dominated strategies (A1, A5, and B2). As a result, this made it possible to simplify the model and to highlight the really significant combinations (A2–A4 and B1, B3).

According to the matrix, the following is known: to find the optimal strategy, we check whether a saddle point exists: the maximum lower value of the game (a) and the minimum upper value of the game (b) are defined as a = max(1, 2, 1.2) = 2 and b = min(3, 6.4, 4.6) = 3. Since a ≠ b, a saddle point is absent. That is, to find the optimal strategy, the authors determined the minimum values of the matrix rows and the maximum values of the columns. Since the maximum lower value of the game (a) and the minimum upper value of the game (b) do not match, there is no saddle point.

Thus, this means that the solution of the game should be sought in mixed strategies. In this situation, the players randomly choose strategies in order to conceal their actions. Within the framework of the study, an analysis of dominant rows and columns was carried out to simplify the matrices. We will now conduct an analysis for the presence of dominant strategies according to the matrix below. It was found that strategy A2 dominates strategies A1 and A5, and strategy B3 dominates B2. By excluding dominated rows and columns, we obtain a simplified matrix.

**Table 6.** Simplified matrix

| | **B1** | **B3** |
|---|---|---|
| **A2** | 1 | 4.6 |
| **A3** | 2 | 3.3 |
| **A4** | 3 | 1.2 |

*Source: compiled by the authors.*
*Note: the calculations are reproducible step by step from the selection of strategies and the elimination of dominated options to the determination of mixed strategies (and the calculation of the Nash equilibrium).*

This allows us to eliminate strategies that will not lead to an optimal outcome. As a result, it was found that strategies A1 and A5, as well as column B2, are dominated (and are also excluded from further analysis).

As noted earlier, the game is solved in mixed strategies, where player I maximizes while player II minimizes their gains. We now solve the system of equations for player I:

$2p2+3p3=2.42$
$3.3p2+1.2p3=2.42$
$p2+p3=1$
After transforming the system, we obtain:
$p2=0.58$, $p3=0.42$
For player II, the system of equations:
$q1=0.68$, $q2=0.32$

Thus, the value of the game is y = 2.42, which indicates the optimal probabilistic strategies for the players: P(0, 0.58, 0.42) and Q(0.68, 0.32).

As can be seen, the final matrix was reduced to the size of 3x2. Using the geometric method, the probabilities of optimal strategies were found. The value of the game (2.42) was also calculated. The players' probability vectors were P(0, 0.58, 0.42) for

player I and Q(0.68, 0.32) for player II. The solution check confirmed its optimality. Thus, the criterion for the optimality of strategies confirmed that all equalities and strict inequalities are fulfilled. As a result, the obtained probabilities can be used to determine strategy in the context of international relations.

In the context of international relations, such probabilities indicate with what chances actors should apply certain strategies. This helps to determine the optimal course of action, taking into account possible losses and benefits from confrontation.

In the cooperative part, the analysis is based on the Shapley value, which shows how the total gain can be fairly distributed under a trust-based interaction (between the EU and the countries of Central Asia). In the non-cooperative model, on the contrary, the Nash equilibrium was used. It reflects the real stability of interaction under conditions where each party pursues its own interests.

Thus, the Shapley model describes an «ideal» scenario of mutually beneficial cooperation, whereas the Nash model represents a likely but more realistic balance under rational behavior of the players.

***Presence of the Interests of Key States***

The presence of other players (the USA, China, and Russia) in the region creates additional challenges and constraints for the development of cooperation in the field of digitalization. Trends indicate that China is becoming a key player in the region alongside Russia and Western powers. Some authors suggest that this may lead to a change in the political and economic environment in the region and to a clash of interests with other superpowers (Nam, 2010).

To carry out calculations using game theory, the authors determined the following parameters: to perform calculations for other players such as Central Asia, the European Union, China, Russia, the USA and other interested parties, it is necessary to take into account their potential strategies, gains and probabilities of success in the context of digitalization and cooperation with the Central Asian and European region. Considering Russia's role in the region, it is necessary to highlight its strategies separately.

***Analysis of CA–Russia Relations***

The role of Russian influence in the dissemination of international community institutions in Central Asia often remains underestimated. For many decades, Russia held an important position in ensuring progress in various fields in the Central Asian region. This view is shared by a number of other authors. Thus, in particular, in the studies (Costa Buranelli, 2014) within the framework of the English School of international relations, it is proposed to consider Russia as a «periphery at the centre». This means that although Russia was part of the European international society, in its influence on Central Asia, it employed its own history and culture. After the CA countries gained independence, for a conditional ten-year period (from the late 1990s to the early 2000s), the presence of Russian influence in the Central Asian region was at a historic minimum. In general, the period of Russia's influence on the region is characterized in sources as an alternative path of dissemination of the norms and institutions of international society into the Central Asian region, referred to as "mediated expansion".

It is obvious that in its current strategy, Russia will attempt to fully restore economic ties with former Soviet countries. In a certain sense, Russia is applying the Schmittian paradigm to the EAEU (Pizzolo, 2023). In other words, there is a global shift from nation-states to highly integrated regional blocs based on civilizational identity.

As an important detail, we consider it essential to note that in choosing their strategies, the CA countries are also guided by other indirect factors. One of the important reasons why CA countries are trying to move away from Russia's sphere of influence is the desire to nationalize and indigenize their territories in order to rectify the perceived dominance of foreign actors and ensure the protection of their indigenous cultures and languages. To some extent, changes are taking place in the CA countries that were also observed in Ukraine. In this case, we are talking about nation-building projects. There is a considerable body of literature that characterizes this issue as part of the problem of national identity formation, including through the example of Ukraine, in the context of its relations with Russia. And although the CA countries do not have the same complex historical connection to the West as Belarus and Ukraine (White, McAllister, & Feklyunina, 2010), the desire to develop along Western lines is popular among the population of the Central Asian region.

Thus, despite attempts by Russia and China to limit the influence of the EU in the region, the Central Asian countries continue to demonstrate their willingness to cooperate and develop their partnerships with various states and regional associations in the field of digitalization. In accordance with the ideas of the authors, a payoff matrix has been constructed below.

**Table 7.** Payoff/Loss Matrices for Players in the Central Asian Region (CA)

| Actions of CA / Actions of Russia or China | Strong Obstruction | Moderate Obstruction | No Obstruction |
|---|---|---|---|
| Full Digital Integration with the EU | (-3, 2, 5) | (-1, 1, 4) | (0, 2, 3) |
| Partial Digital Integration | (-2, 1, 3) | (0, 0, 2) | (1, 1, 2) |
| No Digital Integration | (0, -1, 1) | (1, -1, 1) | (2, 0, 1) |

*Source: compiled by the authors*

As can be seen from the matrix, in each case, the three numbers represent the payoffs/losses for different players. Thus, the first number denotes the payoff/loss for Russia or China. The second number denotes the payoff/loss for the CA countries, and the third number – the payoff/loss for the EU.

It is now important to consider the scenario of full digital integration with the EU. According to the calculations within the matrix, in the case of strong obstruction by Russia or China, the CA countries lose. These values would be (-3) for Russia/China, (2) for CA, and (5) for the EU. According to the authors, this reflects significant economic and political risks for CA. With moderate obstruction, the losses for CA become smaller (-1). The EU still gains (4), and Russia/China lose (-1). In the absence of obstruction, CA and the EU gain (2 and 3, respectively), while Russia/China lose nothing (0). In the case of partial digital integration, strong obstruction leads to losses for CA that are less than with full integration (-2). With moderate obstruction, no one particularly wins or loses (all values are close to 0). When there is no obstruction, the benefit is evident for all parties, though smaller than with full integration. Finally, in the case of no digital

integration, if Russia and China obstruct but CA does not integrate, the benefits shift to Russia/China. The values would be (0) for CA, (+1) for Russia/China. With moderate obstruction, the result is similar (Russia wins, CA loses (-1)). If there is no obstruction, Russia gains (2), and CA gains nothing.

***China's Strategy***

In their study, the authors came to the conclusion that the strategies of China and Russia in Central Asia largely coincide, since both countries strive to strengthen the Eurasian vector and to counter Western influence. Within the framework of the Digital Silk Road initiative, China seeks to establish a dominant role in the digital economy, reinforcing the interdependence of other states (Callahan, 2016; Hussain et al., 2023).

The Belt and Road Initiative, in which the CA countries are actively involved, includes significant digitalization components. The development of infrastructure for next-generation digital technologies such as artificial intelligence, cloud computing, and 5G networks is an integral part of the project. The provision of digital services and content, such as messaging applications, mobile payment systems, and e-commerce platforms in developing markets, only confirms China's (Malik, 2022) aspiration to assert its dominant role.

***EU and Russia/China Matrix***

The strengthening of digital cooperation between the EU and Central Asia compels Russia and China to seek to maintain their influence. At times, they resort to exerting pressure on the countries of the region. In response, the EU, guided by the principle of the "democratic peace," as can be observed, prefers diplomatic influence while avoiding direct confrontation.

**Table 8.** Payoff Matrix for the Choice of Diplomatic Influence Strategies

| **Russia/China (D/U)** | **EU (D) Diplomatic Influence** | **EU (P) Partial Pressure** | **EU (U) Increased Pressure** |
|---|---|---|---|
| Russia/China (D) Diplomatic Influence | (3, 4) | (1, 2) | (-1, 1) |
| Russia/China (P) Partial Pressure | (1, 3) | (0, 1) | (-2, 1) |
| Russia/China (U) Increased Pressure | (0, 2) | (-1, 1) | (-3, 0) |

*Source: compiled by the authors*

According to the calculations in the matrix, the value (3, 4) becomes relevant if both parties choose diplomacy. The payoffs increase to (+3) for Russia/China and (+4) for the EU, indicating stable cooperation and significant benefits. The value (1, 2) is relevant if the EU chooses partial pressure, while Russia/China choose diplomacy accordingly. This leads to smaller but still positive outcomes for both sides. The payoffs (-1, 1) indicate that increased EU pressure against Russia/China's diplomacy brings a small gain for the EU (+1) but losses for Russia/China (-1). The value (1, 3) occurs if both sides apply partial pressure, resulting in moderate payoffs for both. (0, 1) takes place if Russia/China increases pressure while the EU responds with partial pressure. Russia/China remain in a neutral status, while the EU gains a small payoff (+1). When the result is (-3, 0), both players lose under increased pressure: (-3) for Russia/China and a neutral outcome for the EU. This indicates the possibility of conflict escalation.

The payoffs presented in the matrix are derived from the fact that the interests of the Central Asian Republics (CAs) regarding the development of digital transformation are centered around choosing the EU as their main partner. The authors of this study analyzed reports by scholars who have examined China's influence (Kassenova & Duprey, 2021). These materials often state that China still has to earn trust in the CAs. It is important for the CAs to ensure the reliability of the data included in the platform and to consider how this data will be used. In this regard, trust is largely a barrier to cooperation between Central Asia and China. In general, it is important to understand that China's growing involvement in Central Asia in economic, cultural, political, and even military terms remains controversial for the region's inhabitants (Primiano, Rice, & Kudebayeva, 2022).

Another factor for choosing the EU as the main partner in the field of digitalization by the CAs is the emerging competition between China and Russia in the region. The CAs understand that although Russia and China may share similar interests and threats in this region, it does not necessarily mean they will form an alliance in the future (Thomas, 2010). This fact encourages the CAs to develop strategic partnerships with the EU.

***Methodological limitations and directions for future research***

The application of game theory to the analysis of the strategies of the European Union and the countries of Central Asia has a number of methodological limitations. Firstly, game theory is based on the assumption of the rationality of actors and the static nature of their strategies, whereas in real international politics, decisions are often formed under the influence of emotional, cultural, and historical factors.

For example, the strategic choice of Kazakhstan and Uzbekistan is often determined not only by economic benefits. There remains the memory of the Soviet past and the desire to preserve sovereignty and national identity. Similarly, the position of the EU may depend on value orientations as well as on domestic political fluctuations and public expectations.

Secondly, game theory does not take into account such elements as cultural codes, personalism of power, collective narratives, or historical traumas, which can significantly influence the perception of "gains" and "losses". This limits its predictive power when applied to the region of Central Asia.

The authors acknowledge that the rational-choice model used in this study performs an analytical function. In particular, it helps to structure strategic interactions but does not replace a broader political and cultural analysis. In the future, the methodology can be expanded by integrating behavioral and cognitive models, as well as through the application of qualitative approaches (narrative and discourse analysis) to identify the influence of cultural representations on strategic decisions. A promising direction may also be the comparison of model forecasts with empirical data on specific crisis episodes (including energy and sanctions crises).

Finally, it should be noted that a limitation of the model is the assumption of rationality and unity of actors (which does not always correspond to the political reality of Central Asia). In particular, in Turkmenistan, the personalist structure of decision-making may lead to the selection of strategies that do not correspond to economic rationality. This may also concern digital benefits. Thus, forecasts based on payoff matrices may

be less accurate for political systems in which rational–utilitarian criteria give way to ideological or personalist factors.

From the presented matrix and analysis of the materials on the topic, the authors have drawn several key conclusions. The study of this payoff matrix, considering the interests of the EU and Russia/China in Central Asia, may lead to the following conclusions.

As Central Asia becomes an increasingly significant region for geopolitical games, diplomatic influence is likely to remain a key element of cooperation. Both parties, the EU and Russia/China, may seek to use diplomatic channels to establish influence and protect their interests in the CAs.

In the context of competition for influence in Central Asia, increased pressure from the EU or Russia/China may be seen as a strategic move to achieve their goals. For instance, the EU might use increased pressure in response to human rights violations or breaches of democratic principles in the region, while Russia/China might apply pressure to protect their economic or geopolitical interests.

Thus, viewing the payoff matrix in the light of the EU and Russia/China's interests in Central Asia opens new perspectives for analyzing and understanding the geopolitical dynamics in this region.

***Strategic Priorities of the USA in the Central Asian Region***

Although the United States traditionally plays an important role in shaping the world order, its interest in digital cooperation with Central Asia remains limited. This is due to the priority of other regions (for example, the Middle East and the Asia-Pacific) and competition from Russia and China.

In other words, the presence of competition in the form of regional powers and various strategic interests may complicate the USA's attempts to establish cooperation in this field. We believe that, given the current situation and trends in digitalization, the USA may promote a strategy of observation and assessment of cooperation opportunities in the Central Asian region. This may include the following aspects.

Firstly, support for ongoing dialogues and consultations: the USA will continue active engagement with Central Asian states and other international players to understand the needs and priorities in the field of digitalization. This will allow the US leadership to better assess cooperation opportunities and determine strategic directions.

Secondly, investment in development: while the USA may not currently show significant interest in digital cooperation in the Central Asian region, it may continue to monitor developments and invest in projects that present potential long-term value. For example, there is great potential in media literacy for bridging the digital divide.

Thirdly, partnership with other countries and international organizations: the USA may promote a strategy of cooperation with other countries and organizations, such as the European Union, to share experience and resources in the field of digitalization in the Central Asian region.

Thus, the USA's strategy in terms of interaction with the Central Asian countries, the European Union, Russia, and China may be aimed at active observation, dialogue, investment, and support, leaving room for further development of cooperation in the field of digitalization in the future.

***The Position of Central Asian Countries Regarding the Choice of Partner in the Field of Digitalization***

In general, it is important to understand that in the matter of their strategic development in the field of digitalization/digital transformation, the Central Asian countries are primarily guided by the principles of democratic transformation. The Central Asian countries view the EU not only as a potential source of progressive ideas and technologies but also as a platform for strengthening their relations with the global democratic community.

After K. Tokayev assumed the presidency of Kazakhstan and Sh. Mirziyoyev was elected president of Uzbekistan, and the issue of changes in the foreign policy behavior of these two leading Central Asian countries became more relevant. There were various expectations and assumptions in the media regarding how the foreign policy orientation of the countries might change under the leadership of the new presidents. Some authors (Dadabaev, 2019) in their studies explain the continuity and changes in the country's foreign policy course following a change in leadership. Recent trends indicate that the countries are pursuing a policy of multi-vector diplomacy with democratic transformations.

Thus, it is important to understand that the ideological norms of the Central Asian states play a key role in forming new norms for the entire Eurasian space. In this case, we are talking about multi-speed and multi-level Eurasian regionalism, and its spread on a global level. As a result, Central Asia in some way contributes to the development of normative regionalism on a Eurasian scale, which, on the one hand, is beneficial for the main regional actor, Russia.

However, it is also important to note that in developing strategies, the Central Asian countries are guided by non-institutional factors (Lee, 2010). As shown by long-standing trends, in foreign policy decisions, the Central Asian countries fundamentally adhere to "preventive" and "multilateral" diplomacy; the region is dominated by the ideas of "desovietization" and "pragmatism". Finally, the environment in which the countries are developing represents an arena of competition for key international players and may be both a source of opportunities and challenges for Central Asia. These factors influence the foreign policy decisions of the Central Asian countries, particularly the regional leaders Kazakhstan and Uzbekistan, given their weight and significance. Taking into account these and other facts, which will be presented below, the authors of the study have constructed a matrix of gains.

On the other hand, the EU also sees itself as a promoter of values such as democracy, human rights, and innovation in the Central Asian region. Thus, in particular, for the Central Asian countries, further development of e-government is of special interest in the context of their relations with the EU. In the Central Asian countries, there is a real need to use digitalization and digital tools to ensure transparent governance systems (Jonsson & Kotetishvili, 2023).

In addition, with the increasing relevance of the topic of digital transformation in the region, the question arises about establishing ethical limits on methods of data collection for use by algorithms. This refers to ethical issues arising from the use of algorithmic data processing and automated analysis methods (Mutlu, 2015). Given the societal demand for democratic transformation in Central Asian countries, the approaches to digital development by the EU countries are the most appropriate for the Central Asian region.

Cooperation within the framework of EPCA and the digital initiative Global Gateway / Team Europe Initiative contributes to the institutional strengthening of the EU's position in the region. The EU remains the largest trading partner of Kazakhstan. It also actively finances projects on digital and transport connectivity through EIB Global.

These initiatives form sustainable channels of European influence and confirm the second hypothesis of the study, namely that cooperation with Central Asia expands the geopolitical and digital presence of the EU. This part was included by the authors closer to the end of the Discussion section in order to show the strategic consequences of interaction.

## RESULTS

The analytical review of the key actors in Central Asia enabled the authors to examine strategic interactions in the sphere of digital transformation. It also made it possible to model potential scenarios for the development of relations between CA and the EU, as well as CA and Russia/China. The presented payoff matrices demonstrate the gains and losses associated with each strategic choice. Game-theoretic analysis allowed the identification of optimal strategies: for the EU — active engagement with CA in order to maximize economic and digital advantages; and for CA — selecting the most beneficial paths of digital integration with the EU while taking into account the potential actions of Russia and China.

The model also shows that diplomatic strategies yield more favorable outcomes for Central Asia, whereas increased pressure raises risks and may reduce gains. The results obtained indicate that the optimal course for the EU is to deepen cooperation with Central Asia, although, as established by the authors, the countries of the region may not always reciprocate. The January 2024 Resolution of the European Parliament reinforces this tendency and confirms the hypothesis that cooperation with the EU strengthens the region's international connectivity.

The comparison of EGDI indicators demonstrates the growth of the level of digitalization after the entry into force of the EPCA (EU–Kazakhstan Enhanced Partnership and Cooperation Agreement, 1 March 2020). Thus, the value of Kazakhstan's EGDI reached 0.9009 (2024), which is higher than in previous years.

Similar tendencies are observed in Uzbekistan (0.7999) and Kyrgyzstan (0.7316). Although this growth cannot be directly regarded as a consequence of the EPCA, the temporal correlation with the intensification of EU cooperation and the launch of the Team Europe Initiative (2022) on digital connectivity indicates an institutional link between European programs and measurable results of the digital development of the region. We believe that these data strengthen the evidential base and show that

hypothesis No. 1 ("The EU strengthens the connectivity of Central Asia with the global community") is supported by facts.

The study confirmed that active cooperation between the EU and Central Asia contributes to the EU's increased influence in the region. This supports both of the study's hypotheses: that cooperation with the EU strengthens CA's economic and political ties and expands the EU's role in the region. The use of game theory enabled the authors to understand the dynamics of actor interactions in digitalization. We believe that game theory, in the context of digital cooperation between the EU and CA, offers a new methodological approach that accounts for the complexity of strategic decisions. It also helps to understand the ethical and political aspects of cooperation. Additionally, it addresses their impact on global politics.

As a result of the work carried out, the authors identify the following key conclusions.

The necessity to eliminate the gap between normative ethics and political practice in the digital sphere of CA countries to ensure fairness, transparency, and the protection of citizens' rights and freedoms, following the European model.

Considering ethical aspects, there is a need for active interaction and cooperation between the regions of Central Asia and the EU in the field of digitalization to promote economic development, social integration, and improved quality of life for the populations of the CA countries.

Overall, it is important to understand that the nature of political power is being discussed globally in the context of modern information technologies and their influence on data governance in politics. Various studies present examples of the use of databases in areas such as counterterrorism, political campaigns, and biometric systems. For instance, there have been calls (Teboho Ansorge, 2011) for a deeper analysis of the role of databases in politics to better understand modern political dynamics. In light of these changes in digital transformation development, Central Asia views the European Union as a potential partner for deeper cooperation. The EU, in turn, seeks to actively involve Central Asia in its initiatives, such as partnerships in digitalization, knowledge exchange, and expertise. Financial support for the implementation of digital technology development projects in the region is also essential. "Digital tourism", rapidly developing as a promising economic sector (Tashpulatova & Suyunova, 2025), may be of particular interest to the region.

The importance of considering the interests of global powers such as Russia, China, and the United States when developing digital development strategies and mechanisms for international cooperation between CA and the EU.

Overall, taking into account the stated research objective, the authors, having conducted a thorough analysis, were able to draw several key conclusions. Specifically, they relate to digital transformation and international cooperation.

Firstly, probabilities P1A and P1B should be interpreted within the framework of a general strategic approach. In this case, success in cooperation depends on coordinated actions by CA and the EU.

Secondly, optimizing the described probabilities based on the chosen strategies enables the maximization of gains for both parties (CA and the EU).

Thirdly, based on the analysis of probabilities and strategies, specific recommendations are proposed, namely for CA countries to actively engage with the EU. This will ensure the sustainable development of digital infrastructure in the region as a whole.

## CONCLUSION

Thus, in the course of the study, the authors analyzed the key aspects of interaction in the digital sphere, taking into account the interests of various actors in the CA region. Game theory analysis allowed for the examination of different strategies and the prediction of possible outcomes in interactions between CA and other actors.

Based on the conducted analysis, clear conclusions can be drawn that the strategy aimed at strengthening cooperation between CA and the EU (strategy 1 and A) has a high probability of success (P1A). This statement is confirmed by positive modelling results. They demonstrate that such a strategy leads to mutually beneficial development of digital infrastructure and strengthens regional competitiveness. However, it is also important to note that in the event of a refusal to cooperate (strategy 1 and B), the probability of a negative outcome (P1B) increases. This, in turn, may lead to a slowdown in digitalization as well as the deterioration of the political and economic situation in the region. In this regard, the authors recommend strengthening strategic interaction between CA and the EU based on the analysis of the presented probabilities. This approach is aimed at minimizing risks and maximizing the potential of digital technologies to achieve mutually beneficial goals.

As a result, the conducted analysis contributes to the development of game theory and can be applied to the study of strategic relations between East and West. The authors of the study believe that the results have practical value for diplomats, policymakers, and scholars dealing with issues of geopolitics and international relations (Hagemann, Kufenko, & Raskov, 2016).

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## CONFLICTS OF INTEREST

The authors declare no conflicts of interest related to the research, preparation, or publication of this article.

## AUTHORS' CONTRIBUTIONS

AM: conceptualization, methodology, formal analysis, investigation, writing – original draft, writing – review & editing, visualization; YC: methodology, supervision; MS: conceptualization, investigation, project administration; GA: data curation, writing – review & editing.

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