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Modeling the Influence of the Islamic Republic of Iran on the Geopolitical Transformations of Energy in the Mediterranean Sea: A Case Study of the Oil and Gas Industry

Mohammad. Sadegh Rashidi[1], Emran. Alizadeh[2*], Azita. Ragabi[1]

[1] Department of Geography and Urban Planning, CT.C., Islamic Azad University, Tehran, Iran
[2] Department of Geography, Ra.C., Islamic Azad University, Rasht, Iran

*** Corresponding author email address**: emranalizadeh@iau.ac.ir

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This study aimed to develop and validate a model of the Islamic Republic of Iran's influence on geopolitical energy transformations in the Mediterranean Sea, focusing on the oil and gas industry. This applied, non-experimental modeling study combined the DPSIR framework with fuzzy cognitive mapping and partial least squares structural equation modeling. Expert/focus-group judgments were converted into a causal matrix and analyzed in FCMapper and MATLAB to build scenarios and a fuzzy cognitive map. Measurement components were assessed in Smart-PLS using path coefficients, t statistics, and fit indices at the 95% confidence level. All measurement paths were statistically significant ($t > 1.96$). Regional geopolitical and security developments were explained by integration, flexibility, alignment, and management ($\beta = .67–.86$; $t = 13.01–18.09$). Foreign policy and energy diplomacy were explained by cost flexibility, implementation flexibility, adaptability, and recovery/improvement ($\beta = .49–.78$; $t = 8.46–14.42$). Governance, project management, and institutional coordination were explained by planning, continuous improvement, mutual communication, and human resources ($\beta = .67–.86$; $t = 12.87–18.05$). Technological and industrial energy infrastructure was explained by scope, continuous improvement, mutual communication, and human resources ($\beta = .66–.86$; $t = 12.70–18.00$). Economic and financial stability was explained by decision-making method, decision-making style, intra-institutional relations, and legal arrangements ($\beta = .45–.77$; $t = 7.61–13.77$). The validated model indicates that Iran's foreign policy and energy diplomacy are central strategic levers shaping its influence in Mediterranean energy geopolitics, while governance capacity, technological infrastructure, regional security dynamics, and economic-financial stability function as interdependent conditions for sustainable influence in the oil and gas sector.

Keywords: *Energy geopolitics; Mediterranean Sea; Islamic Republic of Iran; oil and gas; energy diplomacy; DPSIR; fuzzy cognitive mapping; PLS-SEM.*

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1. Introduction

Energy geopolitics has become one of the most decisive arenas through which regional powers seek to preserve influence, redefine security relations, and participate in emerging patterns of interdependence. In the contemporary international system, energy is no longer limited to the extraction, production, and export of oil and gas; rather, it constitutes a multidimensional field in which financial markets, infrastructure corridors, environmental

concerns, maritime security, technological transition, sanctions, regional rivalries, and diplomatic alignments interact with one another. The Mediterranean Sea, particularly its eastern and southern basins, has acquired increasing geopolitical importance because it connects Europe, West Asia, North Africa, the Red Sea, and the wider global maritime order. Its strategic position as a bridge between three continents has made it a space in which hydrocarbon resources, energy transit routes, port networks, military deployments, regional alliances, and great-power competition converge. Accordingly, any analysis of energy transformations in the Mediterranean must consider not only the technical and economic dimensions of oil and gas, but also the political, institutional, security, and geostrategic conditions that determine how states gain or lose influence in this complex environment.

The Eastern Mediterranean has undergone a major geopolitical transformation during the last two decades due to new offshore gas discoveries, maritime boundary disputes, the formation of cooperative mechanisms, and the reconfiguration of regional alignments. The emergence of new gas fields has intensified debates over energy security, supply diversification, export routes, and regional cooperation, while at the same time reinforcing competition among states seeking access to markets and strategic influence. The Eastern Mediterranean Gas Forum illustrates the dual character of this region: on the one hand, it institutionalizes cooperation among participating actors; on the other hand, it reflects exclusionary patterns and competitive geopolitical calculations that continue to shape regional energy politics (Mitchell, 2020). In the same context, geopolitical transformation in the Eastern Mediterranean has been influenced by the restructuring role of Greece and the broader diplomatic consequences of the Abraham Accord, which have modified regional balances and generated new forms of political-energy alignment (Bakhshandeh & Yeganeh, 2023). These developments show that Mediterranean energy politics cannot be reduced to resource availability alone; rather, it is structured by diplomatic coalitions, security perceptions, economic partnerships, and the strategic positioning of regional and extra-regional powers.

The strategic and energy-security significance of the Mediterranean is further intensified by the broader transformation of the world ocean and maritime spaces. Maritime domains have become increasingly important for energy transportation, offshore extraction, naval presence, and strategic signaling. In the Eastern Mediterranean, energy security is embedded in a maritime environment characterized by competing claims, fragile cooperation, geopolitical polarization, and the growing relevance of ports, pipelines, and liquefied natural gas infrastructure (Marghelis, 2023). The region is therefore not merely a basin of energy resources, but a geopolitical arena in which maritime access, regulatory arrangements, security guarantees, and diplomatic recognition determine the feasibility of energy projects. This condition makes the Mediterranean highly sensitive to changes in regional conflict patterns, sanctions regimes, energy transition policies, and the strategies of actors that are not geographically Mediterranean but have direct stakes in the region's energy order.

The Middle East and North Africa are experiencing a broader energy transition, but this transition has not eliminated the importance of oil and gas. Instead, it has created a layered geopolitical environment in which conventional hydrocarbons, renewable energy, infrastructure investment, and climate-related pressures coexist. The geopolitics of the global energy transition in MENA requires a careful balance between hydrocarbon dependency, new energy technologies, financial constraints, and geopolitical rivalry (Mills, 2020). Renewable energy adoption in the region is also shaped by geopolitical challenges, including uneven technological capacities, state interests, institutional constraints, and cross-border competition (Hatipoglu et al., 2023). Therefore, although the long-term global energy system is moving toward diversification and decarbonization, oil and gas remain central to the strategic calculations of regional powers. For Iran, which possesses substantial hydrocarbon resources and occupies a sensitive geostrategic position, the Mediterranean energy environment represents both an opportunity for regional role-building and a challenge shaped by sanctions, rivalry, infrastructure limitations, and shifting alliances.

Iran's geopolitical identity is closely tied to its location at the intersection of major energy corridors, maritime routes, and regional security complexes. Iran has increasingly been described as a country situated at the heart of the world's corridors, with a position that connects the Persian Gulf, the Caspian Sea, Central Asia,

the Caucasus, South Asia, and the Middle East to broader transregional networks (Noorali & Ahmadi, 2023). This geopolitical centrality creates strategic potential for influence beyond Iran's immediate borders, including the Mediterranean space. However, potential does not automatically translate into effective influence. Iran's ability to affect Mediterranean energy transformations depends on the interaction between its diplomatic strategy, regional partnerships, institutional coordination, economic resilience, technological capacity, and security environment. In other words, Iran's geographic and energy advantages must be converted into actionable geopolitical influence through coherent governance, adaptive diplomacy, and infrastructural capability.

Iran's regional policy is shaped by both cooperation and confrontation. The rotation of Iran–Saudi Arabia relations between geopolitical interaction and confrontation demonstrates that Iran's regional role has been historically affected by ideological differences, security concerns, competition for influence, and changing diplomatic opportunities (Mousavi et al., 2022). Similarly, the Islamic Republic of Iran's policy toward the Gulf Cooperation Council countries reflects a complex combination of threat perception, regional rivalry, diplomacy, and security calculation (Simbar et al., 2021). These patterns are relevant to the Mediterranean because the regional order of West Asia is increasingly interconnected. Tensions in the Persian Gulf, Syria, the Red Sea, Eastern Africa, and the Levant influence the diplomatic and security environment in which Mediterranean energy relations are formed. Therefore, Iran's role in Mediterranean energy geopolitics must be analyzed as part of a broader regional system rather than as a detached Mediterranean issue.

The Syrian crisis has further linked Iran's regional role to Mediterranean geopolitics. Russian military involvement in Syria and the geopolitics of energy have shown how intervention, security alliances, and energy interests intersect in shaping regional outcomes (Zomorodi Anbaji & Haji-Yousefi, 2021). Syria's geographical position provides strategic relevance because it connects West Asian security dynamics with the Eastern Mediterranean theater. Iran's presence and alliances in the Syrian context have therefore had implications not only for regional security, but also for its indirect access to Mediterranean geopolitics. At the same time, Russia's military and diplomatic presence has altered the strategic environment in which Iran operates, demonstrating that Iran's influence is shaped by cooperation and competition with extra-regional actors. The policies, goals, and interests of Russia and China in West Asia have also affected the Islamic Republic of Iran's interests, especially where great-power strategies intersect with energy routes, sanctions, investment patterns, and regional alignments (Fathabadi & Kamali, 2023).

Iran's relations with Turkey are particularly important for understanding its potential influence in Mediterranean energy transformations. Iran and Turkey are neighboring powers with overlapping interests in borders, energy, water, trade, and regional security. Their geopolitical and security complementarity shows that despite areas of competition, the two countries share certain structural incentives for cooperation in energy and regional connectivity (Omidi & Orhon Ozdag, 2023). Turkey's role as a transit state, its proximity to the Eastern Mediterranean, and its involvement in regional energy disputes make it a key variable in any Iranian strategy toward Mediterranean energy. If Iran seeks to strengthen its influence in Mediterranean energy geopolitics, relations with Turkey must be understood as both a channel of opportunity and a potential source of constraint. Cooperation can support transit, diplomacy, and strategic coordination, while rivalry can reduce Iran's ability to participate effectively in Mediterranean-centered energy arrangements.

Iran's geopolitical environment is also affected by rivalries beyond the Persian Gulf and the Levant. The evolution of Iran–Israel rivalry in the Red Sea and Eastern Africa demonstrates that Iran's regional competition extends into maritime and extra-regional spaces that are connected to Mediterranean security through trade routes, naval presence, and strategic partnerships (Bazoobandi & Talebian, 2023). This rivalry affects Iran's strategic calculations because Israel has become an increasingly active actor in Eastern Mediterranean energy politics, particularly through offshore gas development and cooperation with regional partners. As a result, Iran's influence in Mediterranean energy transformations is shaped not only by its direct energy assets, but also by the regional alignments that include Israel, Greece, Egypt, Turkey, Arab states, and

external powers. Such alignments may either restrict Iran's access to regional energy frameworks or create incentives for Iran to pursue alternative diplomatic and strategic channels.

The increasing role of China in the Persian Gulf also affects Iran's strategic options in the Mediterranean and beyond. China's new role in the Persian Gulf region has implications for the Islamic Republic of Iran because it reshapes investment possibilities, diplomatic balances, infrastructure projects, and energy-market orientations (Nazari et al., 2024). Moreover, broader energy cooperation associated with the Belt and Road Initiative has shown how infrastructure development and project management can transform the geopolitics of energy among regional economic powers (Hao et al., 2020). These developments are relevant to Iran's Mediterranean energy influence because corridors, ports, pipelines, and logistical networks connect the Persian Gulf and West Asia to the Mediterranean basin. If Iran is able to integrate its energy diplomacy with broader infrastructure and connectivity projects, it may increase its strategic weight. However, this requires effective project management, financial stability, institutional coordination, and the ability to navigate sanctions and geopolitical competition.

Geopolitical polarization and energy disintegration in the Middle East and North Africa reveal that regional energy systems are often constrained by political conflict, mistrust, and fragmented institutional arrangements. Natural gas has become an important driver of both cooperation and disintegration, as states seek to monetize resources while simultaneously protecting strategic autonomy and alliance commitments (Lambert & Shath, 2023). This duality is highly relevant to Iran, because its potential influence in the Mediterranean depends on its capacity to operate within a polarized regional environment. On the one hand, Iran has energy resources, corridor potential, and diplomatic networks; on the other hand, it faces sanctions, competing alliances, and limited inclusion in some regional energy platforms. Therefore, Iran's influence should be conceptualized as a systemic outcome produced by the interaction of foreign policy, institutional governance, technological infrastructure, security conditions, and economic-financial resilience.

The relationship between the energy industry, financial markets, environmental concerns, and geopolitics highlights the necessity of studying energy influence through an integrated framework rather than through isolated variables (Pantel, 2024). In the case of Iran and the Mediterranean, oil and gas influence is not determined solely by reserves or export capacity. It is mediated by financial mechanisms, regulatory and legal arrangements, decision-making styles, technological readiness, and the ability to respond to environmental and geopolitical pressures. Economic stability and the national financial system are especially important because long-term participation in energy projects requires investment, risk management, institutional trust, and predictable governance. Similarly, technological progress and industrial infrastructure are essential for converting geopolitical ambition into operational capacity. Without adequate infrastructure, project coordination, and technological capability, diplomatic influence may remain symbolic rather than functional.

Despite the growing body of literature on Eastern Mediterranean energy politics, Iran's regional geopolitics, MENA energy transition, and great-power competition, there remains a need for an integrated model that explains how the Islamic Republic of Iran may influence geopolitical energy transformations in the Mediterranean Sea. Existing studies have separately examined Eastern Mediterranean cooperation and competition, Iran's corridor-based geopolitics, Iran–Turkey complementarity, Iran–Saudi and Iran–Israel rivalries, China's role in the Persian Gulf, Russia's role in Syria, and the geopolitics of energy transition. However, fewer studies have modeled the causal configuration through which diplomatic, security, institutional, technological, and economic-financial factors jointly shape Iran's influence in Mediterranean oil and gas transformations. Addressing this gap requires a methodological approach capable of capturing both systemic interdependence and measurable structural relationships. For this reason, the present study applies a model-based approach that combines fuzzy cognitive mapping with structural equation modeling in order to identify central factors, examine causal patterns, test explanatory components, and present a comprehensive model of Iran's influence in Mediterranean energy geopolitics.

The aim of this study is to present and validate a model of the Islamic Republic of Iran's influence on geopolitical

energy transformations in the Mediterranean Sea, with a specific focus on the oil and gas industry.

2. Methodology

The present study was designed as an applied, descriptive-analytical, non-experimental modeling study aimed at presenting a model of the influence of the Islamic Republic of Iran on geopolitical energy transformations in the Mediterranean Sea, with specific emphasis on the oil and gas industry. The methodological logic of the research was based on integrating the Driver–Pressure–State–Impact–Response framework with partial least squares structural equation modeling and fuzzy cognitive mapping in order to identify, structure, quantify, and validate the causal relationships among the main geopolitical, economic, technological, institutional, and diplomatic factors affecting Iran's role in Mediterranean energy dynamics. The study population consisted of experts and informed specialists in the fields of energy geopolitics, international relations, oil and gas policy, regional security, energy diplomacy, and strategic management. Participants were selected purposively because the research required specialized judgment rather than general population data. The expert panel provided the basis for identifying the main constructs, determining the direction and intensity of causal relationships among factors, and evaluating the conceptual consistency of the proposed model. The main analytical units of the study included foreign policy and energy diplomacy of the Islamic Republic of Iran, regional geopolitical and security developments, governance system, project management and institutional coordination, technological progress and industrial energy infrastructure, and economic stability and the national financial system.

Data were collected through a researcher-developed expert assessment form designed on the basis of the DPSIR conceptual framework and the theoretical literature on energy geopolitics, regional influence, and oil and gas transformations in the Mediterranean region. The instrument was structured to capture expert judgments regarding the causal links among the main components of the model, including driving forces, pressures, state conditions, impacts, and responses. In addition, the tool assessed the perceived influence, dependence, and centrality of each factor in the system. The content of the instrument was developed through a review of previous theoretical and empirical studies and was refined according to expert feedback to ensure conceptual relevance and content validity. The causal assessment matrix was used to determine whether the relationship between each pair of factors was positive, negative, or neutral, and to estimate the relative strength of these relationships. The questionnaire also included indicators related to the latent constructs of the structural model. Regional geopolitical and security developments were represented by indicators such as integration, flexibility, alignment, and management. Foreign policy and energy diplomacy were represented by cost flexibility, implementation flexibility, adaptability, and recovery or improvement. Governance, project management, and institutional coordination were represented by planning, continuous improvement, mutual communication, and human resources. Technological progress and industrial energy infrastructure were represented by scope, continuous improvement, mutual communication, and human resources. Economic stability and the national financial system were represented by decision-making method, decision-making style, intra-institutional relations, and legal arrangements. The collected expert judgments formed the primary empirical basis for developing the fuzzy cognitive map, testing the measurement model, and estimating the structural relationships among variables.

The data analysis process was conducted in several sequential stages. First, the expert judgment matrix was organized, coded, and prepared for fuzzy cognitive mapping. The final matrix derived from the focus group and expert assessments was entered into FCMapper software to calculate the influence, dependence, and centrality indices of each factor. These indices were used to identify the most central and strategically important variables in the model. The output of FCMapper was then used in MATLAB to draw the fuzzy cognitive map and visualize the positive and negative causal relationships among the factors. The size of each node in the fuzzy cognitive map represented its centrality, meaning that larger nodes indicated factors with greater simultaneous influence on and dependence upon other variables. After identifying the central variables, scenario analysis was performed by changing the status of key factors from presence to absence or from stability to disruption. In

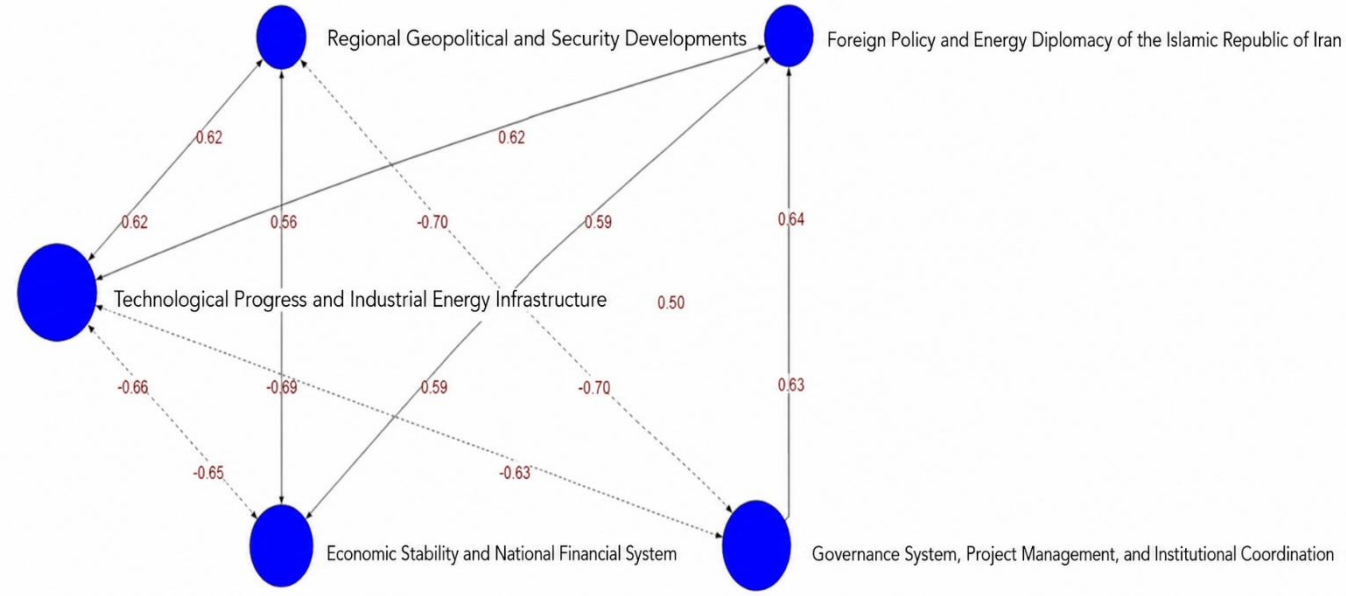
this stage, three major scenarios were examined, including the elimination of foreign policy and energy diplomacy, the elimination of governance, project management and institutional coordination, and the simultaneous maintenance of energy diplomacy with the removal of institutional coordination. These scenarios made it possible to assess how changes in central variables could alter the direction and intensity of other components in the system. In the second stage, Smart-PLS was used to evaluate the measurement and structural models. Confirmatory factor analysis was applied to assess whether the observed indicators adequately explained their related latent variables. Model fit was evaluated using indices such as chi-square divided by degrees of freedom, RMSEA, NFI, GFI, CFI, and IFI. The significance of the paths was examined using standardized path coefficients and t-values at the 95% confidence level, with t-values greater than 1.96 considered statistically significant. The structural equation modeling procedure was therefore used to confirm the direct effects between latent constructs and their indicators and to validate the proposed model of Iran's influence on geopolitical energy transformations in the Mediterranean Sea.

3. Findings and Results

In the first stage of the analysis, the fuzzy cognitive map was developed to identify the causal structure among the main factors shaping the influence of the Islamic Republic of Iran on geopolitical energy transformations in the Mediterranean Sea. For this purpose, the final matrix obtained from expert judgments and the focus group was entered into FCMapper, and the output of this software was then used in MATLAB to draw the fuzzy cognitive map. This stage made it possible to visualize the direction, intensity, and systemic position of the main factors, including foreign policy and energy diplomacy, governance and institutional coordination, regional geopolitical and security developments, technological and industrial energy infrastructure, and economic and financial stability. Figure 1 presents the fuzzy cognitive map of the study.

Figure 1

Fuzzy cognitive map of the factors affecting the model of the Islamic Republic of Iran's influence on geopolitical energy transformations in the Mediterranean Sea



As shown in Figure 1, the fuzzy cognitive map indicates that the factors included in the model are interconnected through both direct and indirect causal relationships. The size and systemic position of each factor reflect its degree of centrality, meaning that factors with greater centrality are simultaneously more influential and more affected by other factors. The map shows that foreign policy and energy diplomacy occupy a central position in

the causal structure of the model, indicating that Iran's geopolitical influence in the Mediterranean energy sphere is strongly shaped by its diplomatic capacity, strategic energy orientation, and ability to manage regional relations. Governance, project management, and institutional coordination also appear as a key systemic factor, suggesting that diplomatic influence cannot be sustained without coordinated institutional mechanisms. Regional geopolitical and security developments, technological progress, industrial energy infrastructure, and economic-financial stability are also embedded in the causal network, showing that Iran's role in Mediterranean oil and gas transformations depends on a multidimensional interaction among political, institutional, technological, security, and economic variables.

Table 1

Results of the FCM model

Factor	Rank	Influence	Dependence	Centrality
Foreign policy and energy diplomacy of the Islamic Republic of Iran	1	3.07	2.46	5.53
Governance system, project management, and institutional coordination	2	2.43	2.43	4.87
Regional geopolitical and security developments	3	2.03	2.77	4.80
Technological progress and industrial energy infrastructure	4	1.85	1.85	3.69
Economic stability and national financial system	5	1.26	1.88	3.15

The FCM results presented in Table 1 show that foreign policy and energy diplomacy of the Islamic Republic of Iran had the highest centrality score among all factors, with a value of 5.53. This indicates that this factor has the greatest combined influence and dependence within the model and therefore functions as the most strategic factor in explaining Iran's role in the geopolitical energy transformations of the Mediterranean Sea. Governance system, project management, and institutional coordination ranked second with a centrality value of 4.87, showing that institutional coherence and coordinated project management are essential for translating geopolitical potential into effective regional influence. Regional geopolitical and security developments ranked third with a centrality value of 4.80 and had the highest dependence score among the factors, suggesting that this dimension is highly sensitive to changes in other components of the model. Technological progress and industrial energy infrastructure ranked fourth, while economic stability and the national financial system ranked fifth. Although these two factors had lower centrality compared with the diplomatic and institutional dimensions, their presence in the causal network demonstrates that Iran's energy influence in the Mediterranean region cannot be explained only through political variables and also depends on technological capacity and financial stability.

Table 2

Scenario analysis based on the FCM model

Scenario	Factor	Stage 1 condition	Stage 2 condition	Stage 1 result	Stage 2 result	Code
Scenario 1: Elimination of foreign policy and energy diplomacy	Foreign policy and energy diplomacy of the Islamic Republic of Iran	1	0	0.59	0.00	0
Scenario 1: Elimination of foreign policy and energy diplomacy	Economic stability and national financial system	1	—	0.59	0.60	2
Scenario 1: Elimination of foreign policy and energy diplomacy	Technological progress and industrial energy infrastructure	1	—	0.75	0.61	6
Scenario 1: Elimination of foreign policy and energy diplomacy	Regional geopolitical and security developments	1	—	0.55	0.00	6
Scenario 1: Elimination of foreign policy and energy diplomacy	Governance system, project management, and institutional coordination	1	—	0.70	0.74	2
Scenario 2: Elimination of governance and institutional coordination	Foreign policy and energy diplomacy of the Islamic Republic of Iran	1	—	0.59	0.67	2

Scenario 2: Elimination of governance and institutional coordination	Economic stability and national financial system	1	—	0.59	0.51	6
Scenario 2: Elimination of governance and institutional coordination	Technological progress and industrial energy infrastructure	1	—	0.75	0.68	6
Scenario 2: Elimination of governance and institutional coordination	Regional geopolitical and security developments	1	—	0.55	0.52	6
Scenario 2: Elimination of governance and institutional coordination	Governance system, project management, and institutional coordination	1	0	0.70	0.00	0
Scenario 3: Maintenance of diplomacy and elimination of governance	Foreign policy and energy diplomacy of the Islamic Republic of Iran	1	1	0.59	1.00	1
Scenario 3: Maintenance of diplomacy and elimination of governance	Economic stability and national financial system	1	—	0.59	0.57	6
Scenario 3: Maintenance of diplomacy and elimination of governance	Technological progress and industrial energy infrastructure	1	—	0.75	0.71	6
Scenario 3: Maintenance of diplomacy and elimination of governance	Regional geopolitical and security developments	1	—	0.55	0.47	6
Scenario 3: Maintenance of diplomacy and elimination of governance	Governance system, project management, and institutional coordination	1	0	0.70	0.00	0

The scenario analysis presented in Table 2 demonstrates how changes in the most central variables alter the configuration of the whole system. In the first scenario, when foreign policy and energy diplomacy were eliminated, the value of this factor decreased from 0.59 to 0.00, and regional geopolitical and security developments also declined sharply from 0.55 to 0.00. At the same time, technological progress and industrial energy infrastructure decreased from 0.75 to 0.61, while economic stability and the national financial system showed only a slight increase from 0.59 to 0.60, and governance and institutional coordination increased from 0.70 to 0.74. This pattern indicates that the removal of energy diplomacy seriously weakens Iran's geopolitical-security position in the Mediterranean energy environment. In the second scenario, where governance, project management, and institutional coordination were eliminated, this factor decreased from 0.70 to 0.00, while economic stability, technological progress, and regional geopolitical-security developments all declined. However, foreign policy and energy diplomacy increased from 0.59 to 0.67, suggesting that diplomacy may become more activated in response to institutional weakness, although this increase is not sufficient to prevent deterioration in the other system components. In the third scenario, foreign policy and energy diplomacy were held constant and strengthened, while governance and institutional coordination were eliminated. Although diplomacy increased to 1.00, economic stability, technological infrastructure, and regional geopolitical-security developments all decreased. This finding shows that diplomatic capacity alone cannot sustain Iran's geopolitical energy influence unless it is supported by effective governance, project management, and institutional coordination.

Table 3

Fit indices of the measurement and structural models

Model	χ^2	χ^2/df	RMSEA	NFI	GFI	CFI	IFI	Result
Regional geopolitical and security developments	5.92	2.96	0.087	0.99	0.99	0.99	0.99	Confirmed
Foreign policy and energy diplomacy of the Islamic Republic of Iran	5.64	2.82	0.093	0.98	0.99	0.99	0.99	Confirmed
Governance system, project management, and institutional coordination	4.53	2.26	0.062	0.99	0.99	1.00	1.00	Confirmed
Technological progress and industrial energy infrastructure	3.58	1.79	0.049	0.99	0.99	1.00	1.00	Confirmed
Economic stability and national financial system	5.16	2.58	0.097	0.98	0.99	0.98	0.98	Confirmed

The fit indices in Table 3 confirm the adequacy of the measurement and structural models. In all five models, the χ^2/df values were lower than the acceptable threshold of 3, indicating appropriate relative fit. The RMSEA values ranged from 0.049 to 0.097, which indicates acceptable model fit across the evaluated constructs. The NFI, GFI, CFI, and IFI values were all above 0.90, confirming that the models had satisfactory comparative and incremental fit. Among the models, technological progress and industrial energy infrastructure showed the strongest fit, with χ^2/df = 1.79 and RMSEA = 0.049. Governance system, project management, and institutional coordination also demonstrated excellent fit, with CFI and IFI values equal to 1.00. Overall, these indices show that the proposed measurement models were statistically acceptable and that the observed indicators adequately represented their corresponding latent constructs.

Table 4

Path analysis results of the structural equation models

Latent variable	Observed indicator	Standardized coefficient	t-value	Result
Regional geopolitical and security developments	Integration	0.68	13.14	Confirmed
Regional geopolitical and security developments	Flexibility	0.83	17.23	Confirmed
Regional geopolitical and security developments	Alignment	0.86	18.09	Confirmed
Regional geopolitical and security developments	Management	0.67	13.01	Confirmed
Foreign policy and energy diplomacy of the Islamic Republic of Iran	Cost flexibility	0.64	11.64	Confirmed
Foreign policy and energy diplomacy of the Islamic Republic of Iran	Implementation flexibility	0.78	14.42	Confirmed
Foreign policy and energy diplomacy of the Islamic Republic of Iran	Adaptability	0.77	14.21	Confirmed
Foreign policy and energy diplomacy of the Islamic Republic of Iran	Recovery/improvement	0.49	8.46	Confirmed
Governance system, project management, and institutional coordination	Planning	0.67	12.87	Confirmed
Governance system, project management, and institutional coordination	Continuous improvement	0.83	17.06	Confirmed
Governance system, project management, and institutional coordination	Mutual communication	0.86	18.05	Confirmed
Governance system, project management, and institutional coordination	Human resources	0.67	12.95	Confirmed
Technological progress and industrial energy infrastructure	Scope/extent	0.66	12.70	Confirmed
Technological progress and industrial energy infrastructure	Continuous improvement	0.83	17.20	Confirmed
Technological progress and industrial energy infrastructure	Mutual communication	0.86	18.00	Confirmed
Technological progress and industrial energy infrastructure	Human resources	0.68	13.14	Confirmed
Economic stability and national financial system	Decision-making method	0.62	10.82	Confirmed
Economic stability and national financial system	Decision-making style	0.77	13.77	Confirmed
Economic stability and national financial system	Intra-institutional relations	0.74	13.13	Confirmed
Economic stability and national financial system	Legal arrangements	0.45	7.61	Confirmed

The path analysis results reported in Table 4 show that all standardized coefficients were positive and all t-values exceeded the critical value of 1.96; therefore, all measurement paths were statistically confirmed at the 95% confidence level. For regional geopolitical and security developments, alignment had the highest loading, followed by flexibility, indicating that coordinated and adaptive regional positioning is central to this construct. For foreign policy and energy diplomacy, implementation flexibility and adaptability had the strongest coefficients, showing that practical diplomatic adaptability is more influential than simple policy declaration. For governance, project management, and institutional coordination, mutual communication and continuous improvement were the strongest indicators, confirming the importance of inter-institutional linkage and ongoing administrative improvement. For technological progress and industrial energy infrastructure, mutual communication and continuous improvement again had the highest

coefficients, suggesting that technological capability depends not only on physical infrastructure but also on organizational and process-based integration. For economic stability and the national financial system, decision-making style and intra-institutional relations were the strongest indicators, while legal arrangements, although weaker than the other indicators, remained statistically significant. Overall, the findings confirm that all observed indicators significantly explain their related latent variables and that the final model has adequate statistical validity.

Figure 2

Final model of the study

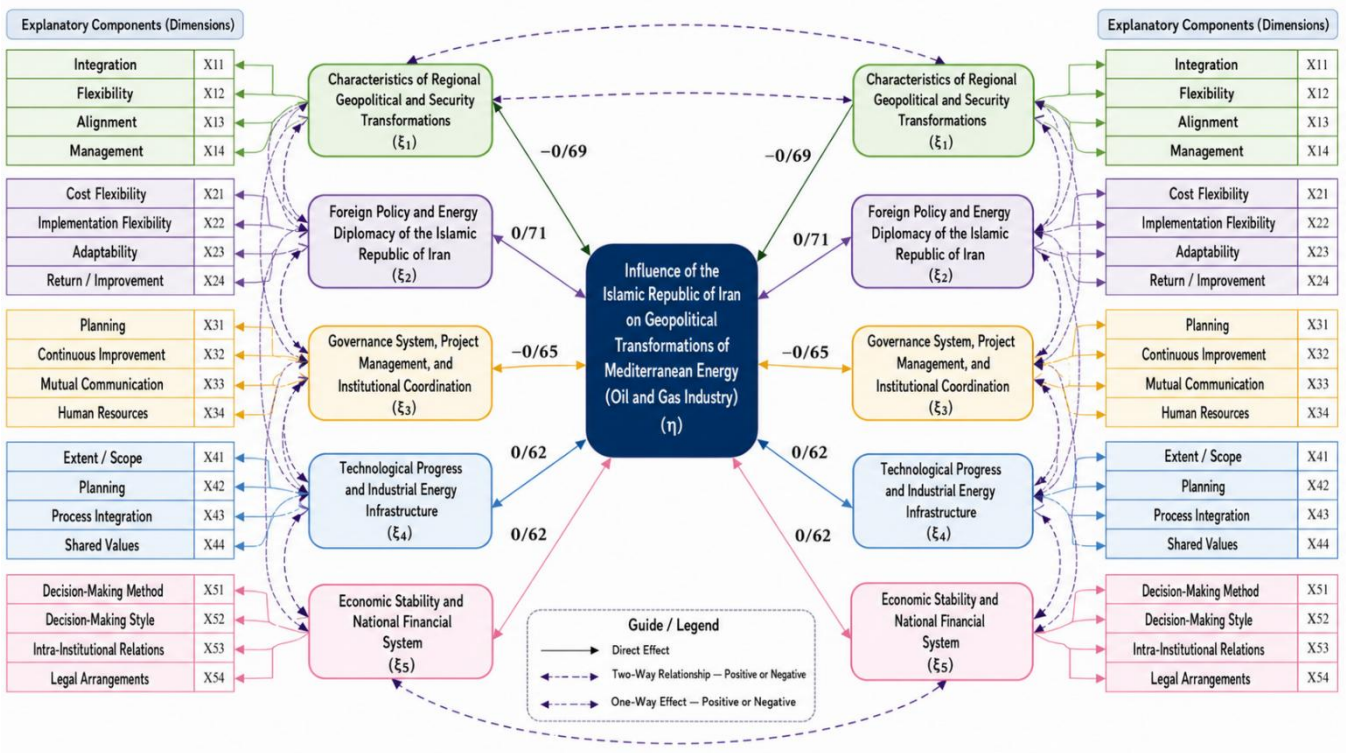


Figure 2 presents the final validated model of the study. The model shows that the influence of the Islamic Republic of Iran on geopolitical energy transformations in the Mediterranean Sea is a multidimensional construct formed through the interaction of diplomatic, institutional, security, technological, and economic-financial factors. The confirmed coefficients indicate that foreign policy and energy diplomacy represent the most central strategic dimension of the model, while governance and institutional coordination provide the organizational capacity required for the implementation of that strategy. Regional geopolitical and security developments define the external environment in which Iran's energy influence is exercised, whereas technological progress and industrial infrastructure determine the operational capacity of the oil and gas sector. Economic stability and the national financial system provide the financial and decision-making foundation necessary for sustaining long-term geopolitical energy influence. Accordingly, the final model confirms that Iran's role in the Mediterranean energy order cannot be attributed to a single political or economic variable; rather, it results from the combined and mutually reinforcing effects of diplomacy, governance, security dynamics, technological capability, and financial stability.

4. Discussion and Conclusion

The present study aimed to present and validate a model of the influence of the Islamic Republic of Iran on geopolitical energy transformations in the Mediterranean Sea, with emphasis on the oil and gas industry. The findings showed that the proposed model has an acceptable empirical and conceptual structure and that the main dimensions of Iran's influence are not

independent or isolated variables, but mutually connected components of a broader geopolitical-energy system. The fuzzy cognitive map demonstrated that foreign policy and energy diplomacy of the Islamic Republic of Iran had the highest centrality among all factors, followed by the governance system, project management and institutional coordination, and then regional geopolitical and security developments. This result indicates that Iran's role in Mediterranean energy geopolitics is shaped first by diplomatic-strategic capacity and then by the institutional ability to operationalize that capacity. In other words, energy diplomacy functions as the main strategic lever, while governance and coordination mechanisms determine whether this diplomatic potential can be converted into sustained influence. This interpretation is consistent with studies that emphasize the importance of Iran's geopolitical position, corridor-based identity, and strategic location in shaping its regional role (Noorali & Ahmadi, 2023). It also aligns with the view that the energy sector is embedded in a broader nexus of geopolitics, financial markets, environmental concerns, and institutional arrangements, meaning that energy influence cannot be understood only through reserves or production capacity (Pantel, 2024).

The finding that foreign policy and energy diplomacy had the highest centrality is theoretically meaningful because the Mediterranean energy environment is shaped by diplomacy, coalition-building, maritime positioning, and participation in or exclusion from regional arrangements. The Eastern Mediterranean has become a field of simultaneous cooperation and competition, where mechanisms such as the Eastern Mediterranean Gas Forum indicate that energy governance is not neutral but reflects strategic alignments and political preferences (Mitchell, 2020). Therefore, Iran's capacity to influence this region depends heavily on whether it can use energy diplomacy to build complementary relations with regional actors, overcome isolation, and respond to changing alignments. The centrality of diplomacy also agrees with research on Iran–Turkey relations, which shows that border, energy, and water issues create both complementarity and competition between the two states (Omidi & Orhon Ozdag, 2023). Since Turkey is one of the most important transit and geopolitical actors connected to the Eastern Mediterranean, the significance of Iran's energy diplomacy in the present model can be explained through the necessity of managing strategic relationships with actors that connect West Asia to the Mediterranean basin.

The results also showed that the governance system, project management, and institutional coordination had the second-highest centrality score in the FCM model. This finding suggests that geopolitical influence is not produced merely through foreign policy declarations or regional ambition; rather, it requires coordinated administrative structures, institutional capacity, project management efficiency, and stable implementation mechanisms. This result is in line with the argument that infrastructure development and project management play a transformative role in energy geopolitics, particularly in the context of large-scale corridor and connectivity projects associated with regional economic powers (Hao et al., 2020). For Iran, participation in Mediterranean-related energy transformations requires the capacity to coordinate policy, finance, infrastructure, and diplomacy. The scenario analysis further supported this interpretation: when governance, project management, and institutional coordination were removed from the model, economic stability, technological progress, and geopolitical-security developments declined, even though foreign policy and energy diplomacy increased. This pattern means that diplomacy may become more active in response to institutional weakness, but it cannot compensate for the absence of coordinated governance. Such a result is particularly important for oil and gas strategy, because energy projects require long-term planning, legal certainty, inter-institutional cooperation, financial reliability, and technological readiness.

The position of regional geopolitical and security developments as the third most central factor confirms that Iran's influence in the Mediterranean cannot be separated from the security environment of West Asia, the Levant, the Red Sea, and the broader Middle East and North Africa. Mediterranean energy politics is embedded in a shifting strategic context in which maritime security, offshore resources, regional polarization, and great-power competition all shape energy outcomes (Marghelis, 2023). The study's finding that this factor had a high dependence score suggests that regional geopolitical and security developments are highly sensitive to changes in diplomacy, governance,

technology, and economic stability. This is consistent with studies showing that geopolitical transformation in the Eastern Mediterranean has been affected by the restructuring role of Greece, the Abraham Accord, and new patterns of regional alignment (Bakhshandeh & Yeganeh, 2023). It also corresponds with the observation that geopolitical polarization and natural gas politics in the Middle East and North Africa can generate both integration and disintegration in regional energy relations (Lambert & Shath, 2023). Therefore, Iran's influence in the Mediterranean energy order depends not only on what Iran does internally, but also on how regional alignments, conflicts, and energy-security institutions evolve externally.

The scenario results provide additional insight into the systemic role of the central factors. In the first scenario, the elimination of foreign policy and energy diplomacy reduced the value of this factor to zero and led to a sharp decline in regional geopolitical and security developments. This result indicates that Iran's geopolitical position in the Mediterranean energy environment is highly dependent on the continuity and effectiveness of its diplomatic-energy strategy. Without energy diplomacy, Iran's ability to shape or respond to Mediterranean developments is substantially weakened. This finding is aligned with research on Iran's regional policies toward the Gulf Cooperation Council countries, which shows that Iran's regional conduct is shaped by a combination of diplomacy, security perception, and strategic response (Simbar et al., 2021). It also reflects the broader reality that Iran's regional influence is frequently mediated by relations with rival and neighboring powers, including the rotating pattern of interaction and confrontation in Iran–Saudi relations (Mousavi et al., 2022). Thus, the decline observed in the scenario model confirms that diplomacy is not a secondary component, but a necessary condition for maintaining influence in an interconnected regional energy system.

In the second and third scenarios, the removal of governance, project management, and institutional coordination produced negative changes in economic stability, technological infrastructure, and regional geopolitical-security developments. Even when foreign policy and energy diplomacy remained active or strengthened, the absence of institutional coordination reduced the performance of other components. This finding has important explanatory value. It suggests that Iran's Mediterranean energy influence requires a dual structure: external diplomatic strategy and internal institutional capacity. The result can be interpreted in relation to the challenges faced by energy-transition and hydrocarbon strategies in MENA, where state capacity, institutional arrangements, technological infrastructure, and geopolitical rivalry directly affect the success of energy policies (Mills, 2020). It also aligns with research showing that renewable energy adoption and broader energy transformation in MENA are constrained by geopolitical and institutional barriers (Hatipoglu et al., 2023). Although the present study focuses on oil and gas, the same logic applies: energy influence requires more than resource possession and depends on governance capacity, institutional coordination, and the ability to manage geopolitical constraints.

The structural equation modeling results further confirmed the explanatory validity of the proposed model. All measurement paths were statistically significant, and all t-values exceeded the critical value of 1.96, indicating that the observed indicators significantly explained their corresponding latent variables. For regional geopolitical and security developments, alignment and flexibility had the strongest coefficients, showing that the ability to align strategies and adapt to shifting regional conditions is essential for explaining this construct. This finding is consistent with the changing and unstable nature of Mediterranean energy politics, where states must constantly adapt to evolving alliances, energy agreements, maritime disputes, and security arrangements (Marghelis, 2023; Mitchell, 2020). For foreign policy and energy diplomacy, implementation flexibility and adaptability had the strongest loadings, confirming that effective diplomacy requires not only strategic orientation but also practical flexibility in execution. This is consistent with studies emphasizing Iran's need to adjust its regional and global strategies in response to shifting geopolitical conditions and the policies of other actors (Nazari et al., 2024).

The confirmed paths related to technological progress and industrial energy infrastructure also highlight the operational dimension of Iran's influence. The strongest indicators in this dimension were mutual communication and continuous improvement, which suggests that technological influence depends not only on industrial assets but also on process integration,

learning capacity, and coordination among actors. This finding can be understood alongside studies that emphasize the role of infrastructure, investment, and project management in transforming regional energy geopolitics (Hao et al., 2020). It also corresponds with research on Russia's and China's policies in West Asia and their impact on Iran's interests, since such policies often operate through infrastructure, strategic investment, energy projects, and geopolitical positioning (Fathabadi & Kamali, 2023). Therefore, the technological-infrastructural component of the model is not merely technical; it is strategic because infrastructure determines whether diplomatic and geopolitical opportunities can be converted into concrete energy influence.

The economic stability and national financial system dimension was also statistically confirmed, with decision-making style and intra-institutional relations emerging as the strongest indicators. This result shows that Iran's influence in Mediterranean oil and gas transformations depends partly on the quality of domestic decision-making and the coherence of institutional relations. Energy projects are capital-intensive, politically sensitive, and exposed to external risks such as sanctions, market volatility, and regional instability. Therefore, a stable financial and decision-making environment is necessary for sustained geopolitical energy influence. This finding aligns with the argument that energy, financial markets, environmental pressures, and geopolitics form an interconnected system (Pantel, 2024). It also reflects the importance of China's expanding role in the Persian Gulf and its possible implications for Iran's strategic and economic options, because financial and infrastructural partnerships can reshape Iran's regional energy opportunities (Nazari et al., 2024). In this sense, financial stability is not simply an internal economic variable; it is part of the external geopolitical capacity of the state.

The findings also contribute to understanding the strategic implications of Iran's rivalry with regional actors. Iran's competition with Israel in the Red Sea and Eastern Africa demonstrates that Iranian influence is increasingly shaped by maritime and transregional rivalries that are indirectly connected to Mediterranean security and energy politics (Bazoobandi & Talebian, 2023). Since Israel is an important actor in Eastern Mediterranean gas development, Iran's regional rivalry with Israel affects the broader context in which energy diplomacy and security positioning operate. Similarly, the geopolitics of energy and Russian military involvement in Syria show that the Eastern Mediterranean cannot be separated from security developments in the Levant (Zomorodi Anbaji & Haji-Yousefi, 2021). Iran's strategic presence and alliances in Syria, along with Russia's role, shape the security context through which Iran may indirectly influence Mediterranean geopolitical dynamics. These studies support the present finding that regional geopolitical and security developments are strongly dependent on diplomatic, institutional, and strategic factors.

Overall, the results confirm that the Islamic Republic of Iran's influence on geopolitical energy transformations in the Mediterranean Sea is a multidimensional and systemic construct. The model indicates that foreign policy and energy diplomacy are the most central factors, but their effectiveness depends on governance, institutional coordination, technological infrastructure, economic-financial stability, and regional geopolitical-security conditions. This finding fills an important gap in previous literature, because many studies have examined Eastern Mediterranean energy politics, Iran's regional rivalries, great-power competition, or energy transition separately, while the present model integrates these elements into a unified causal and structural framework. The final model therefore suggests that Iran's influence in Mediterranean oil and gas geopolitics cannot be sustained through one-dimensional policy action. It requires a coherent combination of adaptive diplomacy, institutional coordination, technological capability, stable decision-making, and strategic awareness of regional transformations.

This study had several limitations that should be considered when interpreting the findings. First, the model was developed based on expert judgments and focus-group assessments; therefore, although the views of informed participants provided valuable specialized insight, the results may still be affected by subjective interpretation and expert selection. Second, the study modeled a complex geopolitical-energy system using selected variables, while real-world Mediterranean energy transformations are influenced by many additional factors, including sudden military conflicts, sanctions, international legal disputes, environmental shocks, and unexpected changes in global energy

markets. Third, the cross-sectional nature of the data limits the ability to capture long-term dynamic changes in Iran's influence, especially because geopolitical relations and energy policies may change rapidly over time. Finally, the study focused specifically on the oil and gas industry, and therefore its findings may not fully represent the broader energy transition, including renewable energy, electricity interconnection, hydrogen, or climate-related investment patterns.

Future studies should extend the proposed model by including a wider range of regional and extra-regional actors, such as Turkey, Greece, Egypt, Israel, Russia, China, the European Union, and Arab Mediterranean states, in order to examine how Iran's influence is shaped within a broader network of cooperation and competition. Longitudinal research is also recommended to evaluate whether the causal relationships identified in this study remain stable over time or change under different geopolitical conditions. Future researchers may also compare the oil and gas sector with renewable energy and emerging energy technologies to determine whether Iran's influence mechanisms differ across energy domains. In addition, mixed-method designs that combine expert modeling with policy documents, trade data, energy infrastructure indicators, and scenario simulations could provide a more comprehensive understanding of how diplomatic, economic, technological, and security factors interact in Mediterranean energy geopolitics.

The findings suggest that policymakers should treat energy diplomacy as a central strategic instrument, but should not rely on diplomacy alone. Strengthening Iran's role in Mediterranean energy transformations requires coordinated governance, coherent project management, institutional integration, technological upgrading, and stable financial decision-making. Practical policy efforts should therefore focus on improving inter-institutional communication, developing long-term energy diplomacy strategies, strengthening legal and financial arrangements for energy cooperation, and enhancing technological and industrial infrastructure in the oil and gas sector. Decision-makers should also develop flexible scenario-based strategies that account for changes in regional alliances, maritime security, sanctions, and energy-market fluctuations. In practice, Iran's influence in Mediterranean energy geopolitics will be more sustainable if diplomatic initiatives are supported by operational capacity, institutional discipline, economic resilience, and strategic coordination across relevant national and regional institutions.

Authors' Contributions

Authors contributed equally to this article.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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The authors report no conflict of interest.

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Ethical Considerations

In this research, ethical standards including obtaining informed consent, ensuring privacy and confidentiality were observed.

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