FEEDBACK-DRIVEN ECONOMIC INTEGRATION BETWEEN THE UAE AND AZERBAIJAN: A SYSTEM DYNAMICS ANALYSIS OF TRADE, FDI, ENERGY TRANSITION AND LOGISTICS–TOURISM CONNECTIVITY

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Abstract: This article develops a feedback-driven conceptual model for analyzing economic cooperation between the United Arab Emirates and Azerbaijan within a System Dynamics framework. The study argues that bilateral economic relations cannot be adequately assessed only through annual trade volumes or foreign direct investment statistics. Instead, UAE–Azerbaijan cooperation should be conceptualized as a dynamic stock that accumulates through trade, FDI, energy cooperation, green investment, logistics connectivity, tourism mobility and institutional coordination, while being weakened by external shocks, project delays, trade costs and implementation failures. The article identifies eight core blocks of the conceptual model: bilateral trade, FDI and investment cooperation, energy cooperation, energy transition and green investment, logistics and corridor connectivity, tourism and mobility, institutional cooperation, and external shocks. It proposes central stocks such as Bilateral Economic Cooperation Stock, UAE FDI Stock in Azerbaijan, Renewable Energy Cooperation Capacity, Logistics Connectivity Capacity, Tourism and Mobility Intensity and Institutional Cooperation Strength. The study also formulates feedback-based hypotheses explaining trade–logistics, FDI–trade–investor confidence, energy cooperation–green FDI, logistics–FDI, tourism–mobility–services trade and institutional cooperation–economic integration mechanisms.

Keywords: UAE–Azerbaijan economic cooperation; System Dynamics; data mapping; proxy indicators; feedback loops; economic integration

Intradaction

Bilateral economic relationships are commonly assessed through static or short-run empirical lenses—trade volumes, investment flows, balance-of-payments effects, and sectoral snapshots—yet real-world cooperation evolves as a dynamic system. In practice, the economic relationship between the United Arab Emirates (UAE) and Azerbaijan is shaped by mutually reinforcing mechanisms: investment decisions respond to market signals and institutional conditions; capacity expansion changes export potential; export performance influences investor confidence; and logistics bottlenecks can offset policy gains. These mechanisms operate with time delays, non-linearities, and capacity constraints. As a result, policy interventions that look attractive in partial-equilibrium reasoning (e.g., investment incentives or trade facilitation measures) may yield weaker-than-expected outcomes if feedback effects and bottlenecks are not explicitly modeled.

This challenge is particularly salient for Azerbaijan's strategic aim to increase non-oil exports and accelerate structural transformation while maintaining macroeconomic resilience. Non-oil diversification is not simply an outcome of "more investment" or "more trade"; it is an emergent result of interacting components—productive capacity, technology transfer, firm capabilities, market access, logistics reliability, standards compliance, and sustained learning in

product and market upgrading. The UAE is a relevant partner in this context because it functions as a global hub for logistics, re-export, services, finance, and investment, and it can provide channels for market access and supply-chain integration that extend beyond the bilateral corridor itself. Yet, harnessing this potential requires policy designs that anticipate how the system behaves under different constraints and shocks.

The central premise of this paper is that the UAE–Azerbaijan relationship can be fruitfully understood as a feedback-driven system, where trade and foreign direct investment (FDI) co-evolve with non-oil diversification. Modeling this co-evolution explicitly is essential for identifying policy packages that can deliver sustained improvements rather than short-lived spikes in flows.

Why a System Dynamics approach is needed

Conventional econometric approaches—gravity models for trade, determinants models for FDI, and time-series methods for macro variables—are indispensable for measuring correlations, elasticities, and average partial effects. However, they often face limitations when the policy question involves:

1. Simultaneous causality (exports affect FDI and FDI affects exports),
2. Delayed effects (investment takes time to become capacity and export outcomes),
3. Non-linear congestion and saturation (logistics capacity constraints), and
4. Policy mix interactions (trade facilitation and investment incentives can reinforce each other or crowd out effectiveness depending on system constraints).

System Dynamics (SD) provides a modeling framework designed precisely for such problems. It represents the economy as interacting stocks (e.g., productive capacity, FDI stock, business relationship capital, logistics capacity, diversification stock) and flows (e.g., capacity expansion, investment inflows, product entry/exit, relationship formation/decay). SD can reproduce complex behaviors—growth, overshoot, stagnation, and recovery—arising from feedback loops. Critically, SD supports policy experimentation under alternative scenarios, including shocks such as corridor disruptions or demand downturns, helping policymakers and stakeholders to assess resilience.

This paper therefore positions SD not as a substitute for econometrics, but as a policy laboratory that integrates empirically grounded parameters (e.g., responsiveness of exports to trade costs; responsiveness of FDI to institutional risk) into a causal structure that captures dynamics.

Conceptual foundations: trade–FDI–diversification as co-evolution

The link between trade and FDI is theoretically ambiguous in sign and mechanism: FDI can substitute for exports (production relocation) or complement it (capacity and productivity enhancement that raises export supply). In the specific setting of Azerbaijan's non-oil diversification, the complementarity pathway is particularly important: FDI can expand productive capacity, upgrade technology, raise quality standards, and enable participation in global value chains, which then enhances export performance. Improved export performance can in turn raise profitability and credibility, feeding back into investor confidence and further investment. This is a classic reinforcing loop.

Diversification adds another layer. Export diversification is not merely "more products"; it reflects a system's learning capacity: firms develop capabilities, accumulate compliance experience, build distribution relationships, and discover viable niches. These processes are path-dependent and slow-moving, making them suitable to be represented as a stock variable. As diversification rises, the export sector becomes less vulnerable to product-specific shocks and can sustain flows under volatility—another reinforcing mechanism that improves confidence and investment prospects.

However, these positive loops are often counteracted by balancing forces. Logistics congestion is a prominent balancing loop: as exports grow, utilization of logistics infrastructure rises; transit time and cost increase; trade costs rise; and export growth slows. Similarly, domestic cost pressures and real exchange-rate appreciation (especially in resource-rich contexts) can reduce competitiveness. A realistic policy model must incorporate both reinforcing and balancing loops to identify where and when policy leverage is strongest.

The UAE–Azerbaijan context and the role of trade costs

Bilateral cooperation between Azerbaijan and the UAE takes place in a broader geography of corridors and hubs. The UAE's role as a logistics and re-export hub means that "exports to the UAE" can be interpreted not only as final destination trade but also as a gateway to wider markets. Meanwhile, Azerbaijan's strategic location and infrastructure ambitions position it as a potential connector in Eurasian logistics. In such a context, trade costs are not only tariffs; they include border procedures, reliability of transit, shipping connectivity, and the availability of trade-related services (finance, insurance, certification, and distribution networks). The non-tariff nature of many barriers implies that improvements often require institutional reforms and coordinated investments, and their impacts typically appear with delays.

Moreover, the effectiveness of investment incentives depends on whether complementary constraints are addressed. For example, if investment incentives raise FDI inflows but logistics capacity and service quality do not adjust, the system can move into a congestion regime that compresses gains. This paper's modeling strategy directly addresses this reality by allowing logistics capacity and trade facilitation to interact with investment inflows and export growth.

Research gap and contribution

Despite growing interest in Azerbaijan's diversification agenda and in Gulf–Caucasus economic linkages, existing studies tend to focus on either trade or investment separately, or they treat their interaction as a static relationship. Less attention is devoted to dynamic mechanisms: how investment becomes export capacity, how relationships and market access accumulate, how logistics constraints become binding, and how these forces shape long-run diversification trajectories.

This paper contributes in four ways:

1. Dynamic integration of trade and FDI: We construct a feedback-based SD model in which exports, FDI, capacity accumulation, and confidence co-evolve endogenously rather than being imposed as one-directional causality.
2. Diversification as a stock of capabilities: We represent diversification as a slowly adjusting state variable driven by learning, entry, and market discovery, allowing policy to influence not only volumes but also resilience.
3. Explicit modeling of logistics bottlenecks: We capture congestion and saturation effects through non-linear relationships between utilization, transit time, and trade costs, which is essential for realistic policy evaluation.
4. Policy-mix experimentation and resilience: We evaluate policy packages—trade facilitation, investment incentives, and targeted capacity/logistics upgrades—under baseline and shock scenarios to identify robust strategies.

Research questions and hypotheses (feedback-oriented)

Guided by the conceptual structure above, the paper addresses the following research questions:

- RQ1: How does a reduction in trade costs (through trade facilitation and logistics improvements) change the trajectory of Azerbaijan's non-oil exports to the UAE?
- RQ2: To what extent does UAE-origin FDI amplify non-oil export growth via capacity expansion and diversification, and what delays govern this transmission?
- RQ3: Under what conditions do logistics bottlenecks dominate the system, reducing the effectiveness of investment incentives?
- RQ4: Which policy mix (trade facilitation, investment incentives, and capacity expansion) produces the most resilient outcomes under corridor and demand shocks?

Corresponding hypotheses are formulated in dynamic terms:

- H1 (reinforcing): Trade facilitation lowers trade costs, increases export flows, and strengthens investor confidence, generating a reinforcing cycle that raises UAE-origin FDI and export capacity.
- H2 (capability accumulation): UAE-origin FDI increases productive capacity and accelerates capability accumulation, raising export diversification and stabilizing non-oil export growth over time.
- H3 (bottleneck dominance): When logistics utilization approaches capacity, congestion increases transit time and trade costs, activating a balancing loop that dampens export growth and reduces the marginal impact of incentives.

- H4 (policy complementarity): Combined policy packages (facilitation + incentives + capacity/logistics investment) outperform single-instrument interventions in long-run diversification and resilience.

Overview of the modeling strategy

To answer these questions, we develop an SD model with five core stocks: (i) UAE-origin FDI stock, (ii) non-oil production capacity, (iii) business relationship capital, (iv) diversification stock, and (v) logistics capacity. Export flows are generated as a function of production potential, market access, competitiveness, and trade costs; trade costs depend on logistics time and facilitation effort; FDI inflows depend on incentives, institutional risk, and investor confidence; diversification evolves through learning and market discovery with entry and exit dynamics. The model is calibrated using available macro and sectoral data and validated using structural and behavioral tests.

International economic relations in the modern era cannot be explained only through the prism of classic "export-import" or "capital flows". Changes in the structure of the global economic system over the past decade — energy security crises, post-pandemic supply chain restructuring, regional geoeconomic blockade, green energy transition, increasing strategic importance of logistics corridors, restoration of tourism and human mobility — necessitate a more complex and systematic explanation of bilateral economic relations. In this regard, the example of the United Arab Emirates and Azerbaijan is of particular research importance. Although both countries are rich in energy resources, in recent years they have been pursuing an active policy towards economic diversification, development of the non-oil sector, renewable energy projects, international logistics and service exports. Therefore, the study of UAE-Azerbaijan economic relations should not be limited to statistical analysis of current trade turnover and investment flows, but, on the contrary, should be examined on the basis of the long-term structural dynamics of these relations, channels of interdependence and feedback mechanisms.

Economic cooperation between Azerbaijan and the UAE has entered a new institutional stage in recent years. The UAE–Azerbaijan Comprehensive Economic Partnership Agreement – CEPA – signed in 2025 and entering into force in April 2026 – transforms this relationship from simple trade cooperation to a broader economic integration platform. According to official data, CEPA is not only aimed at reducing tariffs, but is also intended as a long-term mechanism for trade diversification, expanding investment flows, integrating supply chains, and digital economic cooperation. This is an important starting point for the theoretical substantiation of the dissertation: the UAE-Azerbaijan relationship is no longer just energy diplomacy or a classic trade partnership, but is being shaped as a multi-sectoral economic system.

The first important block of this system is bilateral trade and foreign direct investment. In modern literature, trade and FDI are no longer explained as separate economic flows, but as mutually complementary and sometimes substitutable mechanisms. According to the global value chain approach, a country's trade relationship with another country is not only the exchange of finished goods, but also the cross-border movement of intermediate goods, services, technologies, management knowledge and capital [23]. This approach is particularly relevant in UAE-Azerbaijan relations, as the UAE acts as a regional finance, logistics, tourism, aviation and green energy hub, while Azerbaijan has an important hub position in the energy, transport and Middle Corridor geoeconomy for the South Caucasus and the Caspian basin. As a result, trade and FDI relations between the two countries are not only linked to bilateral market expansion, but also to access to third markets, regional logistics connections and energy transition projects.

The second important block is energy cooperation and energy transition. Although Azerbaijan is traditionally known as an oil and gas exporting country, in recent years it has become more active in renewable energy, green energy corridors and diversification of energy exports. The UAE has become a country that invests in green energy projects on a global scale through global renewable energy companies such as Masdar. The commissioning of the Garadagh Solar Power Plant by Masdar in Azerbaijan and the discussion of solar and wind projects up to

1000 MW indicate that UAE-Azerbaijani cooperation has entered the energy transition phase. In this context, energy cooperation no longer only covers hydrocarbon trade, but also areas such as renewable energy production, electricity export, green technologies, carbon reduction policies and energy security.

The third block is logistics, tourism and mobility. The UAE is one of the world's leading centers in the global aviation, port management, tourism and international services sectors. Azerbaijan, on the other hand, is strengthening its position as a transit country in the Europe-Asia connection through the Baku International Sea Trade Port, the Alat Free Economic Zone, the Baku-Tbilisi-Kars railway and the Middle Corridor. In this regard, logistics is not just a technical infrastructure for freight transport, but also acts as a system variable for reducing trade costs, expanding market access, increasing FDI attractiveness, and increasing tourism mobility. Recent studies show that logistics performance, the quality of transport infrastructure, and trade facilitation have a significant impact on countries' trade volume, FDI flows, and service exports [22] [23.

The main objective of this subsection is to conceptualize the UAE–Azerbaijan international economic relations along three interrelated dimensions: first, bilateral trade and FDI relations; second, energy cooperation and energy transition; and third, the logistics–tourism–mobility system. These three dimensions are not mutually exclusive. Trade growth increases the demand for logistics infrastructure; logistics development strengthens the attractiveness of FDI; FDI expands production capacity in the energy, tourism and service sectors; energy transition stimulates new technology and capital flows; and tourism and mobility provide additional impetus to trade and investment relations through service exports, aviation connections and cultural-economic convergence. These interactions create a favorable research area for the System Dynamics approach, as there are numerous feedback loops, lags, nonlinear effects and policy scenarios. From a System Dynamics perspective, the UAE–Azerbaijan economic relations can be modeled through several main stocks and flows. For example, the “bilateral economic integration stock” can reflect the overall level of trade volume, FDI accumulation, institutional agreements, logistics connections and energy projects. Inflows to this stock may be new trade agreements, investment projects, energy cooperation agreements, expansion of flights and logistics routes. Outflows may be related to geopolitical risks, market constraints, energy price shocks, regulatory barriers and the strengthening of competitive alternative corridors. Thus, this subsection serves as a conceptual basis for the subsequent methodological chapters.

Consequently, the study of UAE–Azerbaijan economic relations is relevant both theoretically and practically. From a theoretical point of view, these relations are located at the intersection of international trade, FDI, energy transition, logistics and tourism literature. From a practical point of view, these relations are of great importance in terms of Azerbaijan’s non-oil diversification, the UAE’s foreign investment and green energy strategy, the geoeconomic importance of the Middle Corridor and the formation of the Caspian–Caucasus–Gulf economic space. For this reason, it is appropriate to conduct the research using the System Dynamics approach: because this approach allows us to model not simple cause-and-effect relationships, but long-term structural dynamics, policy lags, reinforcing and counterbalancing feedback loops, and scenario outcomes.

The literature on international economic relations has undergone a significant transformation in the last decade. In traditional theories, economic relations between countries were mainly explained by comparative advantages, the distribution of production factors, trade costs and market size. However, in the period after 2016, global value chains, regional trade agreements, the quality of FDI, energy transition, green technologies, logistics linkages, digital services and geoeconomic risks have become the main explanatory variables of international economic relations. Baldwin (2016) explains the essence of the “new globalization” in terms of the international fragmentation of production, the cross-border diffusion of technology and the inclusion of services in trade. According to this approach, economic relations between countries are no longer just the exchange of products, but the integration of production, technology, management and logistics networks.

The World Bank (2020) evaluates global value chains as a source of productivity, employment and export diversification for developing countries. However, this approach also shows that integration into GVCs is not possible only through tariff liberalization; for this, logistics infrastructure, trade facilitation, institutional stability, investment climate and human capital are also important. This idea is of particular importance for the UAE–Azerbaijan case. Azerbaijan can expand transit and production linkages through the Middle Corridor and energy infrastructure, while the UAE can offer expertise in capital, logistics management, ports, aviation and the service sectors. Thus, the economic relationship between the two countries can also be explained as a regional variation of GVCs.

Regional trade agreements and economic partnership agreements also occupy an important place in the recent literature. While Khalid emphasizes the potential of regional trade agreements to increase international trade flows, he shows that their impact depends on the depth of the agreement, institutional implementation mechanisms, and the reduction of non-tariff barriers. This conclusion is also relevant for the UAE–Azerbaijan CEPA. If CEPA is limited to tariff concessions, its impact may be limited; however, if it deepens in areas such as investment, services, digital trade, logistics, and standards harmonization, it can create systemic economic effects. Official UAE data indicate that CEPA aims specifically at trade diversification, investment expansion, and supply chain integration.

The FDI literature has also shifted in recent years from quantitative indicators to qualitative and structural effects. UNCTAD's World Investment Report considers FDI not only as a capital flow, but also as a channel for technology transfer, capacity expansion, employment, innovation and sustainable development (UNCTAD, 2023, 2024). The OECD's FDI quality approach also shows that the impact of investments on economic development depends on their sector focus, linkages with local companies, technology transfer and compatibility with green transformation (OECD, 2022). In this regard, in addition to the volume of FDI in the UAE–Azerbaijani relationship, its sectoral structure – energy, logistics, tourism, agribusiness, digital services and green technologies – should be analyzed separately.

Elimam (2025) shows that FDI can be a strategic tool for sustainable economic growth in oil-dependent economies. According to the author's findings, FDI can contribute to economic diversification by stimulating the development of sectors such as information technology, renewable energy and tourism. This idea is theoretically relevant for both the UAE and Azerbaijan. Both countries are trying to develop their non-oil sectors using hydrocarbon revenues. However, the success of this process depends not only on capital investment, but also on institutional quality, human capital, technology transfer, and long-term sector strategies.

Gana [17] studies the energy transition and economic diversification process in the Gulf countries and shows that tourism, finance, logistics and renewable energy sectors have become key priorities in the Gulf countries' post-oil development model. This finding is important for explaining the UAE's foreign economic strategy. The UAE is not only diversifying domestically, but also playing an active role in regional and global economic networks through foreign investments. Masdar's involvement in renewable energy projects in various countries, including Azerbaijan, is a practical example of this strategy. According to Reuters, Masdar increased its global clean energy portfolio to 65 GW by 2026 and maintained a target of 100 GW by 2030.

A major change in the literature on energy cooperation over the past decade is that energy security and energy transition are no longer presented as contradictory concepts, but as mutually complementary strategies. IEA (2023, 2024) shows that the share of renewable energy sources in the global energy system is growing rapidly, but the security of natural gas and energy infrastructure still plays an important role in the transition period. IRENA (2023, 2024) emphasizes that the energy transition is not only a matter of technological change, but also of investment, policy coordination, grid infrastructure, energy storage and regional electricity trade. This approach is particularly important for Azerbaijan: the country is both an energy partner exporting gas to Europe and wants to become an

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exporter of electricity and green energy in the future through projects such as the Caspian-Black Sea-Europe green energy corridor.

Azerbaijan Ministry of Energy data indicate that energy cooperation with the UAE is discussed in the context of renewable energy, gas exports, access to European markets and a green energy corridor through the Black Sea. This shows that energy cooperation in UAE-Azerbaijan relations has a multidimensional character. While traditional energy cooperation was limited to oil and gas trade, in the new phase, areas such as solar and wind power plants, electricity exports, regional interconnectors, carbon reduction, and energy diplomacy are coming to the fore.

Studies examining the relationship between energy transition and trade and FDI have also increased in recent years. Zhang [24] examines the impact of international trade on renewable energy efficiency, showing that trade can be an important channel for technological progress and efficiency gains. Musse (2025) highlights the role of institutional factors in energy transition by analyzing the relationship between FDI, trade openness, political stability, and renewable energy consumption. Pan (2025) examines the impact of FDI and renewable energy consumption on technological breakthroughs and environmental outcomes. The overall conclusion of these studies is that FDI and trade can stimulate energy transition, but this effect is not automatic; the sector of investment, technology content, government policies, and institutional quality play a crucial role.

This conclusion is very relevant in the UAE–Azerbaijan case. Masdar's projects in Azerbaijan should be analyzed not only in terms of energy production, but also in terms of green FDI, technology transfer, and energy policy coordination. The Garadagh Solar Power Plant and the potential 1000 MW new projects are significant in terms of attracting foreign capital and technology to Azerbaijan's renewable energy sector. However, the macroeconomic impact of these projects is related to their local industrial linkages, employment creation potential, grid integration and export opportunities. In the System Dynamics model, these relationships can be modeled as a feedback loop "green energy investment → renewable capacity → energy diversification → export potential → economic integration". The tourism and mobility literature also plays an important role in explaining the UAE–Azerbaijani relationship. Tourism is no longer just a leisure sector, but is also described as a complex economic system involving service exports, human mobility, aviation connections, cultural convergence and investment attractiveness. Alsabhan [1] studies the relationship between international tourism and economic growth and shows that tourism stimulates economic dynamics, but this effect depends on the country context, infrastructure and inter-sectoral linkages. Wijesekara et al. (2022) examine Granger causality and wave coherence between tourism and economic growth at the global level, showing that tourism is an important component of long-term economic dynamics.

The relationship between tourism, FDI and environmental sustainability has also been extensively studied in recent years. Hasan (2026) analyses the impact of tourism, FDI, trade openness and energy consumption on the ecological footprint of South Asian countries. Gharbi (2025) shows that tourism and industrialisation increase carbon emissions, while renewable energy and financial development reduce emissions. These studies show that tourism cooperation in UAE–Azerbaijan relations should be assessed not only in terms of income and service exports, but also in terms of sustainable tourism, green transport, aviation emissions and environmental management. As the UAE is one of the largest aviation and tourism hubs in the world, expanding air links with Azerbaijan could have a direct impact on bilateral tourism and business mobility. The UAE Embassy in Baku reports that cooperation between the two countries has expanded in the areas of industry, energy, agriculture, communications, high technologies, transport, trade, investment, tourism and new air routes. This shows that tourism and mobility are linked to trade and FDI. Increased air connectivity can stimulate business travel, investor meetings, tourism flows and trade in services. At the same time, tourism flows increase cross-border recognition and create a socio-cultural basis for long-term economic cooperation.

The main idea in the logistics literature is that transport infrastructure and trade facilitation are

the "hidden determinants" of international economic relations. WTO (2023) emphasizes the importance of logistics connectivity for trade sustainability in the context of the re-globalization of trade and the risks of regional fragmentation. IMF (2026) in its study on North Africa and regional connectivity shows that trade liberalization, logistics quality and improvement of the business environment are mutually complementary conditions for exports and economic growth. This conclusion is also relevant for Azerbaijan. Azerbaijan's position in the Central Corridor and the UAE's global logistics experience create a potential area of cooperation between the two countries.

The UAE's logistics advantage is not only related to its geographical location, but also to the institutional efficiency of port management, air transport, free economic zones, customs procedures and the service sector. Azerbaijan, on the other hand, is increasing its importance on the China-Central Asia-Caspian-Caucasus-Europe route through the Middle Corridor. From this perspective, UAE-Azerbaijan logistics cooperation can be explained at three levels: first, reducing trade costs; second, developing regional transit and multimodal transportation; third, investment cooperation in free economic zones, ports and logistics services. In the System Dynamics model, this relationship can be established as a reinforcing loop of "logistics capacity → trade facilitation → bilateral trade volume → investor confidence → logistics investment".

Geoeconomic aspects of energy, logistics and trade also occupy a wide place in modern literature. The pandemic, the Russia-Ukraine war, the Red Sea and other transport risks have made the sustainability of supply chains a strategic priority. In this context, alternative routes such as the Middle Corridor and regional energy connections are gaining more importance. Azerbaijan is at the center of these processes in terms of both energy and logistics. The UAE is an important actor managing capital and logistics connections between the Gulf, Asia, Africa and Europe. For this reason, economic relations between the two countries should be examined not only at the bilateral level, but also in the broader Eurasian-Gulf geoeconomic space. The interaction between FDI and logistics is also of particular importance. In addition to market size, logistics costs, customs procedures, transport connections and access to regional markets are important factors for investors. If Azerbaijan is presented to UAE investors not only as a domestic market, but also as a platform for accessing the markets of the South Caucasus, Central Asia and Europe, investment attractiveness may increase. This approach is also consistent with CEPA's goal of supply chain integration. At the same time, the UAE's logistics and free zone experience can be a source of institutional learning for projects such as the Alat Free Economic Zone and the Baku Port in Azerbaijan.

The concept of "green FDI" is increasingly used in the energy transition literature. Trung (2025) defines green FDI as investment flows directed towards areas such as renewable energy, green infrastructure and ecotourism. This approach is particularly useful in the UAE–Azerbaijani relationship, as Masdar's projects are not just energy sector investments, but also examples of green FDI. Such investments bridge the gap between economic diversification and ecological transformation. However, the real impact of green FDI depends on its integration into the local economic system, the participation of local companies in the projects, technology transfer and human resource development.

Smaoui (2025) examines the impact of renewable energy, green technology, FDI and globalization on green economic growth, showing that these variables are not separate but rather interacting development mechanisms. This result is important for the System Dynamics approach. Because in the SD model, renewable energy investment does not only increase energy production; it can also affect the country's green image, investor confidence, technology transfer, export potential, and tourism attractiveness. Such multi-channel effects should be considered in the UAE–Azerbaijan model.

The energy wealth of the UAE and Azerbaijan makes their economic relationship special. In traditional international economic theories, energy exporters are often analyzed in the context of resource dependence, Dutch disease, and oil price shocks. However, recent literature shows that energy wealth can be transformed into a source of finance for diversification with the right institutional and investment policies. The UAE is an interesting example in this regard: the

country has used oil revenues to develop aviation, tourism, logistics, finance, real estate, and renewable energy sectors. For Azerbaijan, this experience is not a model to be directly copied, but a source of comparative institutional learning. There is also a close connection between energy diplomacy and economic diplomacy in the UAE-Azerbaijani relationship. Hosting COP29 in Baku strengthened Azerbaijan's position on the energy transition and climate diplomacy agenda. According to a Carnegie Endowment analysis, COP29 highlighted the growing role of Gulf companies in the clean energy sector in the South Caucasus and Central Asia, and Masdar's 230 MW Garadagh Solar Power Plant in Azerbaijan was noted as one of the important examples of this process. The Middle East Institute also emphasizes that Azerbaijan wants to become a more active actor in the field of energy transition and green energy exports on the eve of COP29.

However, the literature also shows the contradictions of the energy transition. On the one hand, fossil fuel exporting countries develop green energy projects, while on the other hand, they continue to depend on oil and gas revenues. This situation can be explained as a "dual transition" or "managed transition". This approach is also suitable for Azerbaijan and the UAE: both countries still receive large revenues from energy exports, but at the same time invest in the development of renewable energy, green technology and non-oil sectors. In the System Dynamics model, this contradiction can be shown by two different feedback mechanisms: "fossil revenue → investment capacity → green transition" and "fossil dependence → transition delay".

The issue of mobility has gained wider meaning in the literature on international economic relations in recent years. Human mobility is not only related to migration, but also to business travel, tourism, education, professional contacts, conferences, air transport and trade in services. In the UAE–Azerbaijani relationship, mobility can serve to expand economic trust, social recognition and business networks between the two countries. In particular, the role of the UAE as a global tourism and aviation hub, and Azerbaijan's regional tourism potential and the future tourism development opportunities of post-conflict areas provide rich material for research in this area.

Studies on the tourism–FDI relationship show that tourism infrastructure often develops with foreign investment, while tourism flows also strengthen the country's investment image. Nahiduzzaman (2026) emphasizes that FDI can affect tourism competitiveness through transport networks, hotel infrastructure and service innovations. When applied to the UAE–Azerbaijani relationship, the tourism sector should be analyzed not only in terms of visitor numbers, but also in terms of investment, service quality, aviation connectivity and brand image.

An important methodological trend is also observed in the literature. Previous studies have mainly used econometric methods such as gravity models, panel regressions, ARDL, VAR and causality tests. However, single linear models are not sufficient for the analysis of multi-sectoral relationships such as trade–FDI–energy–logistics–tourism. These systems contain delays, nonlinear effects, policy interventions, interdependencies and feedback mechanisms. Therefore, the System Dynamics approach creates a methodological advantage for such research. The SD approach allows modeling the behavior of economic relations over time through stocks, flows, auxiliaries and feedback loops.

The first feedback mechanism that can be applied to the UAE–Azerbaijan economic relations is the "trade–logistics–investment" cycle. As trade increases, the demand for logistics infrastructure increases; as logistics infrastructure improves, trade costs decrease; the decrease in trade costs stimulates new investments; and FDI further expands trade volume by increasing production and service capabilities. This is a reinforcing loop. However, there are also factors that limit this loop: customs barriers, limited market size, institutional delays, transportation costs and geopolitical risks.

The second feedback mechanism is the "energy cooperation–green investment–economic diversification" loop. Energy cooperation stimulates the entry of UAE investors into Azerbaijan; green energy projects diversify Azerbaijan's energy balance; energy diversification strengthens the country's green economic image; this image

attracts new investments and international partnerships. However, this loop is not automatic either. Limited network infrastructure, regulatory delays, weak local technology base and financial risks can slow down the process.

The third feedback mechanism is the "tourism–mobility–service trade–institutional convergence" loop. As tourism and air links increase, business mobility expands; business mobility increases investor networks and service trade; service trade strengthens economic confidence between countries; this in turn stimulates new tourism and investment flows. The UAE's tourism and aviation advantage, and Azerbaijan's regional tourism and cultural heritage potential, form the practical basis of this loop.

In conclusion, the literature of the last 10 years shows that it is not enough to approach international economic relations only through trade volume and investment statistics. In the UAE–Azerbaijan case, trade, FDI, energy cooperation, energy transition, logistics, tourism and mobility are interconnected system elements. Each of these elements can strengthen or limit the other. Therefore, the main scientific contribution of this study may be to model these relationships within the framework of System Dynamics, identify feedback structures and assess the long-term consequences of various policy scenarios.

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BƏƏ VƏ AZƏRBAYCAN ARASINDA ƏKS-ƏLAQƏYƏ ƏSASLANAN IQTISADI INTEQRASIYA: TICARƏT, XARICI BIRBAŞA INVESTISIYALAR, ENERJI KEÇIDI VƏ LOGISTIKA-TURIZM ƏLAQƏSININ SISTEM DINAMIKASI TƏHLILI

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Xülasə: Bu tədqiqat Birləşmiş Ərəb Əmirlikləri ilə Azərbaycan arasında formalaşan iqtisadi inteqrasiyanı əks-əlaqə mexanizmlərinə əsaslanan System Dynamics yanaşması çərçivəsində araşdırır. Ənənəvi yanaşmalardan fərqli olaraq, məqalədə ikitərəfli iqtisadi münasibətlər yalnız ticarət dövriyyəsi, xarici birbaşa investisiya axınları və ayrı-ayrı sektor göstəriciləri ilə deyil, uzunmüddətli qarşılıqlı təsirlər, gecikmələr, qeyri-xətti əlaqələr və məhdudlaşdırıcı amillər əsasında izah olunur. Tədqiqatın əsas diqqəti qeyri-neft ticarəti, BƏƏ mənşəli FDI, enerji keçidi, logistika potensialı, turizm-mobillik əlaqələri və institusional əməkdaşlığın birgə inkişafına yönəlmişdir. Məqalədə göstərilir ki, ticarət və investisiya axınlarının iqtisadi nəticələri avtomatik xarakter daşımır; bu nəticələr istehsal potensialının toplanması, logistika darboğazları, investor inamı, siyasət koordinasiyası və sektorlararası tamamlayıcılıqdan asılıdır. BƏƏ-nin qlobal logistika, maliyyə, turizm və yaşıl enerji mərkəzi kimi rolu, Azərbaycanın isə Orta Dəhliz, enerji keçidi və qeyri-neft diversifikasiyası baxımından artan əhəmiyyəti xüsusi vurğulanır. Tədqiqatda FDI ehtiyatı, istehsal potensialı, biznes əlaqələri kapitalı, diversifikasiya ehtiyatı və logistika potensialı kimi əsas stock dəyişənlərinə əsaslanan System Dynamics modeli təklif olunur.

Açar sözlər: UAE–Azərbaycan iqtisadi əlaqələri; System Dynamics; xarici birbaşa investisiya; qeyri-neft diversifikasiyası; logistika bağlantıları; enerji keçidi.

ЭКОНОМИЧЕСКАЯ ИНТЕГРАЦИЯ МЕЖДУ ОБЪЕДИНЁННЫМИ АРАБСКИМИ ЭМИРАТАМИ И АЗЕРБАЙДЖАНОМ НА ОСНОВЕ МЕХАНИЗМОВ ОБРАТНОЙ СВЯЗИ: СИСТЕМНО-ДИНАМИЧЕСКИЙ АНАЛИЗ ТОРГОВЛИ, ПРЯМЫХ ИНОСТРАННЫХ ИНВЕСТИЦИЙ, ЭНЕРГЕТИЧЕСКОГО ПЕРЕХОДА И ВЗАИМОСВЯЗИ ЛОГИСТИКИ И ТУРИЗМА

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Резюме. В настоящем исследовании экономическая интеграция между Объединёнными Арабскими Эмиратами и Азербайджаном рассматривается в рамках методологии **System Dynamics**, основанной на механизмах обратной связи. В отличие от традиционных подходов, двусторонние экономические отношения анализируются не только через показатели товарооборота, потоков прямых иностранных инвестиций и отдельных отраслевых индикаторов, но и с учетом долгосрочных взаимосвязей, временных лагов, нелинейных зависимостей и ограничивающих факторов.

Основное внимание в исследовании уделено развитию ненефтяной торговли, прямых иностранных инвестиций из ОАЭ, энергетическому переходу, логистическому потенциалу, взаимосвязи туризма и мобильности, а также институциональному сотрудничеству. В статье показано, что экономические результаты торговых и инвестиционных потоков не носят автоматического характера, а зависят от накопления производственного потенциала, наличия логистических ограничений, уровня доверия инвесторов, координации государственной политики и межотраслевой взаимодополняемости.

Особо подчеркивается роль ОАЭ как глобального центра логистики, финансов, туризма и зеленой энергетики, а также возрастающее значение Азербайджана в качестве ключевого участника Среднего коридора, страны, осуществляющей энергетический переход и диверсификацию ненефтяного сектора экономики.

В исследовании предложена модель **System Dynamics**, основанная на ключевых переменных типа **stock**, включая накопленный объем прямых иностранных инвестиций, производственный потенциал, капитал деловых связей, потенциал диверсификации и логистический потенциал.

Ключевые слова: экономические отношения ОАЭ–Азербайджан; System Dynamics; прямые иностранные инвестиции; диверсификация ненефтяного сектора; логистические связи; энергетический переход.