



Analysis of Factors Influencing Development of Academic, Technological and Social Knowledge Growth Indicators in the United Arab Emirates, Saudi Arabia, Turkiye and Iran

Samad Izadi¹(Corresponding author)
Kobra Gholamalitabar Firouzjaee²

ARTICLE INFO	ABSTRACT
<p>Received: 02 March 2025 Revised: 31 May 2025 Accepted: 31 July 2025 Online: 07 June 2026</p>	<p>This study examines the factors influencing the growth of academic, technological, and social knowledge in the United Arab Emirates, Saudi Arabia, Turkiye, and Iran. The research employs a qualitative comparative approach, and data analysis was conducted using Bereday's four-stage model, including description, interpretation, juxtaposition, and comparison. The selected countries were chosen based on the strategy of "similar social systems with different educational outputs." Data were collected through documentary analysis of primary and secondary sources, including international reports and scholarly articles from reputable databases such as Taylor & Francis, Emerald, Noormags, Magiran, SID, ScienceDirect, ProQuest, OECD, and UNDP. The Global Knowledge Index, developed under the supervision of the United Nations Development Programme, was used to assess various dimensions of knowledge growth. The research findings indicate that the performance of all selected countries in terms of the share of government budget allocated to higher education investment compared to other educational levels, the level of academic freedom, investment in digital services, online commerce, and high-technology exports is not satisfactory. In terms of social knowledge growth, all countries show strong performance in healthcare services and internet accessibility but face challenges in environmental sustainability. The results also indicate that the UAE prioritizes internationalization of higher education, Saudi Arabia emphasizes gender equality, while Iran and Turkiye focus on quantitative expansion. Iran demonstrates relatively strong educational and research resources but weaker university-industry collaboration. Additionally, the UAE and Saudi Arabia outperform Turkiye and Iran in digital service accessibility, while weaker corruption control in Iran and Turkiye negatively affects their supportive social environments.</p>
<p>KEYWORDS</p> <p>Development Higher Education Knowledge Growth Supportive Environment Technological Knowledge</p>	

¹ Professor, Department of Educational Sciences, Faculty of Humanities and Social Sciences, University of Mazandaran, Babolsar, Iran. Email: s.izadi@umz.ac.ir

² PhD Student, Department of Educational Sciences, Faculty of Humanities and Social Sciences, University of Mazandaran, Babolsar, Iran. Email: k.gholamalitabar71@gmail.com

1. Introduction

With the emergence of globalization, the role of education in development has undergone profound transformations, as many countries seek to compete internationally by producing knowledge-based goods and services. This global competitiveness has highlighted the importance of education and contributed to the growth of knowledge-based economies, which, in turn, enhance welfare, reduce poverty and inequality, and foster sustainable societies (Odhiambo, 2024; Veckalne & Tambovceva, 2022). Integrating knowledge into development models has shifted attention from traditional production factors toward the central role of knowledge and innovation. Accordingly, investment in education is recognized as a key driver of productivity and competitiveness, serving as a cornerstone of sustainable economic growth. Although knowledge growth manifests in multiple forms, both the quantity and quality of its dimensions significantly influence national economic development (Turanjanin & Cvetanovic, 2021).

Knowledge growth can be categorized into three primary dimensions: academic, technological, and social. Academic knowledge growth concerns the expansion and advancement of knowledge within educational and research institutions. It includes curriculum design, enrollment rates, quality of educational resources, academic diversity and freedom, educational equity, research outputs, and scholarly publications (Lytras et al., 2019). Technological knowledge growth reflects a country's capacity for innovation and the development of new technologies, typically measured by patent registrations, research and development investment, high-technology exports, and the provision and accessibility of digital services (Pozovna, Krawczyk, & Babenko, 2023). The social dimension emphasizes the societal context that enables decision-making capacity, social participation, and equitable access to resources. Key indicators include political stability, corruption control, rule of law, gender equality in social participation, public health, and environmental performance. A supportive socio-political environment, alongside active civic engagement, is essential for formulating and implementing effective knowledge development and educational policies (Nelson, 2014; UNDP, 2023).

The relationship between academic knowledge growth and economic development is multidimensional. Higher education enrollment rates positively correlate with economic growth; studies in Indonesia show that higher education participation and educated human capital significantly contribute to long-term growth (Meilisa, Elfindri, Anas, & Ariyanto, 2024). However, the impact of academic knowledge on economic development also depends on the quality of educational resources—financial, material, and human—as well as curriculum quality, which enhances student engagement and equips graduates with market-ready skills (Dhakal, Surya

Bahadur, Khatri, & Paudel, 2024). Furthermore, knowledge growth in higher education requires infrastructures such as international collaborations and academic freedom. Strengthening international partnerships can increase foreign revenue, productivity, global market participation, diplomatic relations, research capabilities, multicultural educational environments, and international recognition (Molaei Aliabad et al., 2023). Universities that embrace equality and diversity also expand their scientific output and societal engagement, whereas restrictions on academic freedom suppress critical discourse (Esmat, 2024; Vögtle & Windzio, 2024).

In general, progress in information and communication technology (ICT) has created new tools for innovation and knowledge diffusion, and advanced countries have invested heavily in this area (Perez-Trujillo & Lacalle-Calderon, 2023). Supporting technological innovations helps reduce costs and trade barriers and boosts online business. Studies show that the development of technical infrastructure has led to an increase in regional exports, particularly in the Persian Gulf region (Nipo, Bujang, & Hassan, 2018).

Economic development is also shaped by a stable socio-political environment. Countries with political stability and resilience against crises, such as war or extremism, achieve faster and more secure growth (Kumar & Kaur, 2024). Limited corruption, accountability, and transparency are key elements of good governance that directly facilitate foreign investment (Dobrowolska, Dorożyński, & Kuna-Marszałek, 2023). Environmental performance of citizens further reflects the cultural and educational achievements of higher education graduates (Qi, 2023).

The transition from traditional to knowledge-based economies has been central to Iran's development and global competitiveness, enabling the practical utilization of educational investments (Rezaeinejad, Lavrov, & Simonov, 2023). Integration of digital technologies has contributed to environmental sustainability, balanced economic and ecological objectives, and supported overall development (Wang, Umair, Oskenbayev, & Saparova, 2024). Technological knowledge growth enhances social indicators, strengthens public and private sector performance, and fosters innovative entrepreneurial models (Mohajerani, Baptista, & Nandhakumar, 2015).

Nevertheless, Iran faces challenges including weak support mechanisms, fragmented policies, bureaucratic and regulatory obstacles, limited financial incentives, and restricted tax benefits, resulting in a relatively small contribution of the knowledge-based economy to GDP (Erfanian et al., 2024; Fotoohi, 2024; Mehrara et al., 2016; Behboodi et al., 2015). While Iran's neighbouring countries, through international cooperation, investment in technology, and its transfer to sectors such as tourism, aviation, finance, and port management, are seeking to achieve a dynamic economy (Akkas & Altiparmak, 2023; Chaziza, 2024). Given the foregoing discussion, it is

necessary to take a brief look at the findings of previous studies at both the international and national levels.

Alqhtani (2025) highlights that macro- and micro-level educational strategies—including dynamic learning environments, adoption of emerging technologies, industrial partnerships, international cooperation, and application of academic research to societal challenges—drive knowledge- and innovation-based economic development. AL-Ali et al. (2025) find that sustainable investments in all educational levels, innovation, ICT development, and a favorable economic and institutional environment have been key in harnessing knowledge for production in the UAE. Byasharova (2025) notes that technology and digitalization investments in Gulf countries have expanded foreign trade and regional economic integration, though Pereverzyeva (2024) cautions against over-reliance on foreign labor. Al-Hajri et al. (2024) report that government institutions, economic incentives, education investment, and ICT development have been decisive in advancing the UAE's knowledge-based economy, aligned with Abu Dhabi's 2030 vision for a diversified and sustainable economy.

Esmat (2024), highlighting the importance of the university environment, concludes that a university that embraces the principles of equality and diversity can enhance both its academic performance and the breadth of its engagement with society. Conversely, a university that restricts academic freedom tends to suppress critical discourse. Khatib et al. (2023) highlight UAE initiatives in sustainability, including “Zero Waste City” and green architecture, while Saudi Arabia advances its economic goals through knowledge and technology development. Alharthi (2019) adds that GCC countries aim to strengthen human capital, promote technology exchange, and reduce dependency on oil revenues. Focusing on the role of scientific research in shaping a knowledge-based economy in the GCC countries, Wirba (2017) argues that some of these states, in the process of diversifying their economies, face challenges such as low levels of investment in research and a non-applied approach to science. Many of them remain in the early stages of establishing an efficient research ecosystem for economic development. Jia (2015) study, which concentrates on private firms in China, demonstrates that the economic capacity of these firms is positively associated with supportive government strategies. Accordingly, supportive policies and a well-developed legal system have contributed to enhancing their innovation capacity.

The findings of Borhanipour et al. (2021) underscore that improving good governance indicators—as the foundation for the growth of social knowledge and the establishment of efficient institutions—plays a significant role in enhancing economic growth in countries with medium and high per-capita income. Among these indicators, transparency, accountability, and the control of

administrative corruption exert a positive and meaningful impact on real GDP growth. The study by Panahi et al. (2020), which offers a comparative analysis of cross-border higher education as an indicator of international scientific cooperation, shows that although Iran's national policy documents emphasize becoming a regional hub of international education, actual planning has often been passive. In contrast, the southern Persian Gulf countries have adopted an active, strategic, and forward-looking approach. Research by Madandar Arani et al. (2019) demonstrates that countries in the region—including the UAE and Saudi Arabia—have performed better than others by investing in indicators such as human resource development, student recruitment, equipment, financial resources, and the enhancement of educational system performance. According to this analysis, Iran ranks seventh among 13 neighboring countries in educational indicators. Kian (2019) comparative analysis of technological investment in general education in Australia, Finland, and Iran reveals that despite implementing initiatives such as smart schools, Iran still faces major challenges, including weak private-sector participation, a lack of long-term investment, and the absence of a coherent evaluation system.

Further regional evidence underscores persistent challenges in Iran. Entazari (2018) found that provincial universities have limited impact on regional development due to insufficient utilization of local capacities and the absence of a robust ecosystem linking academic activity to economic and social systems. Mirzaei and Banouei (2015) emphasize that skilled human capital growth exerts the greatest influence on provincial economic growth, while Shahabadi and Salimi (2015) highlight that R&D progress, foreign investment, and human capital enhancement in developed countries result from effective governance. Zarei-Mahmoudabadi et al. (2014) report that Iran ranks 13th among 14 neighboring countries in R&D capacity, far from the ambitions set in national policy documents.

Additional research shows that strong socio-political environments are essential for fostering academic and technological knowledge growth, and their synergy with social knowledge contributes to sustainable economic development. However, despite the recognized link between knowledge growth dimensions and sustainable development, no prior research has conducted a comparative and simultaneous analysis of all three dimensions in Gulf region countries. Therefore, the present study aims to analyze academic, technological, and social knowledge growth indicators in the United Arab Emirates, Saudi Arabia, Turkiye, and Iran. To achieve this aim, the study addresses the following research questions:

- What similarities exist in the academic, technological, and social knowledge growth indicators among the four selected countries?
- What differences exist in the academic, technological, and social knowledge growth indicators among the four selected countries?

2. Research Method

This study employs a qualitative research design, with documentary analysis serving as the primary method of data collection. The research is conducted at the macro-analytical level (national level) and is grounded in George F. Bereday's four-stage comparative framework. Knowledge growth is recognized as a multidimensional construct encompassing a wide range of interrelated indicators. In this regard, the present study seeks to examine the various dimensions of knowledge growth from a sustainable development perspective through the systematic classification of sub-indicators and the development of composite macro-indicators. Nevertheless, the inclusion of additional indicators and the application of alternative theoretical perspectives remain feasible for future investigations.

To operationalize qualitative findings into measurable quantitative rankings, the study adopts the internationally recognized Global Knowledge Index (GKI) (United Nations Development Programme, 2023). The assessment of the academic knowledge growth sub-index incorporates several key indicators, including national rankings in public expenditure on higher education, enrollment rates across educational levels, availability of educational and research resources, university–industry collaboration, scientific publication output, graduate unemployment rates, and the level of academic freedom.

The evaluation of technological knowledge development is based on indicators such as investment in telecommunications infrastructure, internet accessibility levels, digital service accessibility, online service trade, and high-technology exports. Furthermore, the analysis of the enabling socio-political environment encompasses indicators including political stability, governance effectiveness, rule of law, corruption control, gender equality, public health conditions, and environmental performance.

For the purpose of comparative analysis and regional contextualization, four countries—namely the United Arab Emirates, Saudi Arabia, Turkiye, and Iran—were selected based on the comparative strategy of “similar social systems with divergent educational outcomes.” In addition to sharing comparable climatic characteristics and religious-cultural values, these countries have

consistently emphasized the transition toward knowledge-based economies and the reduction of oil dependency within their national strategic development agendas. The shared policy orientation toward knowledge growth provides a robust foundation for comparative evaluation and facilitates the identification of critical determinants influencing the advancement of educational infrastructure.

The data utilized for comparative analysis were derived from scholarly articles, policy documents, books, and international reports published between 2000 and 2025. These sources were retrieved from reputable academic and international databases, including Emerald, ScienceDirect, Taylor & Francis, Springer, Elsevier, OECD, ProQuest, UNDP, Noormags, Magiran, and SID. To enhance the credibility and validity of the findings, methodological triangulation was employed through the integration of multiple data sources in the analysis of each indicator. In addition, expert consultations were incorporated to further strengthen the reliability and analytical rigor of the study. Moreover, detailed documentation of the research procedures, data collection processes, and analytical methods was provided to ensure transparency and maintain research objectivity.

3. Findings

To describe and interpret the state of knowledge growth in the academic, technological, and social dimensions among the selected countries, this study draws on the findings of credible international and domestic research, as well as official reports from relevant ministries. This approach ensures the validity of the data and enables a precise and comparable analysis of the indicators.

A) Descriptive

United Arab Emirates

Over the past decade, the United Arab Emirates (UAE) has emerged as one of the most successful models of economic diversification within the Gulf Cooperation Council (GCC) region. This transformation has been largely driven by strategic policy prioritization of a knowledge-based economy, with particular emphasis on research and development, technological advancement and export, and strengthening human capital competitiveness through educational reform (Al-Dulaimi et al., 2022; Yagis, 2024). Historical evidence suggests that earlier national development agendas in the UAE focused primarily on establishing a knowledge-based society and recognizing education as a central pillar of sustainable development (Assaf, 2011). More recent policy directions, however,

have shifted toward attracting foreign direct investment to accelerate technology transfer, facilitating knowledge diffusion through multinational corporations (Chabani et al., 2024), expanding entrepreneurship education (Khalil et al., 2024), and establishing international branch campuses within higher education systems (Kairanbayev & Kudoibergenova, 2022). These initiatives collectively reflect the UAE's strategic commitment to strengthening knowledge production and innovation capacity.

The UAE currently allocates over 20% of its government expenditure to education and has implemented comprehensive structural reforms aimed at enhancing learning outcomes and improving its global innovation performance. Central to this transformation has been the implementation of several national strategic frameworks, including UAE Vision 2021, the National Innovation Strategy, UAE Vision 2031, and the UAE Centennial Plan 2071 (Areepattamannil, 2024). Analysis of these strategic frameworks indicates a sustained and coordinated policy trajectory toward strengthening knowledge-driven development across successive planning periods. The UAE Economic Vision 2031 establishes measurable performance targets, including increasing gross domestic product from AED 1.49 trillion to AED 3 trillion, expanding non-oil exports to AED 800 billion, increasing tourism's contribution to GDP to AED 450 billion, and raising total foreign trade to AED 4 trillion. Furthermore, the UAE Centennial Plan 2071 is structured around four strategic pillars: forward-looking governance, enhancement of higher education quality, expansion of the knowledge economy, and promotion of social well-being and cohesion (UAE Government, 2023; Ministry of Economy UAE, 2020). These findings highlight the critical role of long-term national planning and macro-level policy interventions in fostering technological innovation and knowledge-based economic transformation.

Saudi Arabia

Saudi Arabia's governance structure is characterized by a centralized monarchical system in which political authority is concentrated within the ruling family and strongly influenced by Islamic legal principles. Despite this centralized governance model, the government has introduced limited mechanisms for public participation, including the enactment of the Basic Law of Governance in 1992 and the establishment of local consultative councils (Alkhoraif, 2024).

Saudi Arabia's historical reliance on oil revenues, particularly between 1969 and 1980, prompted policymakers to initiate comprehensive economic reforms under Vision 2030. This strategic framework prioritizes economic diversification, transition toward a knowledge-based economy, and expansion of sustainable energy infrastructure (Lianos-Antczak, 2022). Vision 2030

is built upon three interrelated pillars: a vibrant society, a thriving economy, and an ambitious nation. These reforms represent a strategic response to global oil price volatility and the need to enhance long-term economic resilience (Hassan et al., 2024).

As part of its transition toward knowledge-based development, Saudi Arabia has implemented extensive educational reforms, including curriculum modernization, expansion of private higher education institutions, and improved gender and geographic equity in educational access (Maspul, 2024). Empirical evidence suggests that strengthening digital economic sectors and knowledge-intensive industries—particularly in non-oil sectors—remains essential for achieving Vision 2030 objectives (Neffati & Jbir, 2024). Moreover, sustained investments in information and communication technology infrastructure have enhanced digital service delivery and strengthened Saudi Arabia's global economic competitiveness (Amor, 2024).

Major national corporations, including Saudi Aramco, SABIC, and Taqnia, have established collaborative partnerships with universities and specialized research and development centers to enhance knowledge transfer and industrial innovation (Opeyemi Akinwale & Surujlal, 2021). Despite these advancements, research indicates that national investment in research and development remains insufficient to fully support long-term innovation goals. Oil dependency continues to shape investment priorities, and Saudi Arabia remains reliant on foreign expertise in advanced knowledge sectors such as nanotechnology and renewable energy (Omri et al., 2023).

Turkiye

Turkiye has pursued extensive economic liberalization policies characterized by market-oriented reforms, reduced state intervention, and long-standing efforts toward European Union integration (Yilmaz, 2015). These structural transformations have significantly influenced educational reform, particularly within higher education institutions (Ozturk & Dayloglu, 2024). Within this policy framework, strengthening technological infrastructure across multiple economic sectors has become a major governmental priority (Ari, 2021). Empirical findings demonstrate that improvements in human capital development, information technology capacity, and foreign trade integration have significantly contributed to Turkiye's economic growth (Ismihan, 2024). Recent data further indicate that increased investment in research and development has facilitated measurable industrial innovation and technological advancement. Nevertheless, the contribution of high-technology exports to Turkiye's gross domestic product remains relatively modest (Akkus, 2024).

Bibliometric and regional analyses reveal that while the citation impact of Turkish scientific publications has improved in recent years, it continues to remain below the global average (Maral, 2024). Within the higher education sector, gross enrollment rates have surpassed 100%, reflecting substantial expansion in tertiary education access. However, research productivity and knowledge generation among graduate students and academic institutions remain below expected international performance benchmarks (Cobanoglu & Fatih Kose, 2024; Ozer, 2024).

Iran

The policy of supporting and developing science, technology, and industry in Iran, based on the core slogan of the political system – “independence and self-sufficiency” – has always been a government priority (Soufi, 2011). To achieve this goal, after the Islamic Revolution in the late 1970s, the government formulated and implemented six five-year economic and social development plans and is currently executing the seventh plan. In these development programmes and other policies, emphasis has been placed on reducing dependence on oil revenues, increasing investment in general, technical, vocational, and higher education, and developing science, technology, and innovation (Shaghaghi, 2018). In this regard, science and technology parks were established to bridge the gap between idea generation and the production of goods and services, to meet real needs, and to provide high-value-added services up to the commercialisation stage (Mahdavi, Sheikh Zeineddin, & Khodabandeh, 2011). Iran’s performance in quantitative knowledge growth indicators, such as the number of scientific articles in global databases, shows a relative increase (Azadi Ahmadabadi, 2022). This growth has been more pronounced in basic science disciplines such as engineering and technology, natural sciences, and agriculture (Supreme Council of Science, Research and Technology, 2024). At the same time, the utilisation of intellectual assets and knowledge produced in higher education centres remains low, and the share of research and development (R&D) and the technology market in the country’s gross domestic product (GDP) is modest (Emami, 2017; Komijani & Memarnejad, 2004; Pourezzat, Gholipour, & Nadirkhanloo, 2009). Moreover, research by Shojaee and Beigi (2009) on the ICT indicator shows that investment in information technology has not had a significant impact on economic growth or GDP due to its negligible share. Exclusion from large-scale scientific projects, reduced university research budgets, the dominance of a memory-based education system, and complex administrative bureaucracy are the main obstacles to achieving Iran’s scientific goals.

B) Interpretation

United Arab Emirates

Since the late twentieth century, the United Arab Emirates has undertaken a strategic transformation from a hydrocarbon-dependent desert economy into a globally integrated, knowledge-driven economic model (Siddiqi & Ibne Afzel, 2022; Aarepattamanni, 2024). Policymakers in the UAE have prioritized educational investment, research and development, and technology transfer as central mechanisms for achieving sustainable economic diversification (Hameed et al., 2016; Shadab & Alam, 2024). UAE policymakers have also designed the use of technology across six axes – environment, transport, education promotion, personal and public health, economy, and governance – as a vision for smart cities (Gandam et al., 2024; Khatib et al., 2023). Significant investment in technological infrastructure has enabled the UAE to implement advanced urban development strategies in arid environments. These initiatives include large-scale desalination projects, water recycling systems, innovative architectural design, renewable energy integration, and biodiversity conservation programs (Alogayell et al., 2024). The expansion of technological growth in the UAE has been supported not only by strong governmental policies but also by substantial inflows of foreign direct investment. According to the World Investment Report (UNCTAD, 2024), The value of inward foreign direct investment (FDI) in the UAE reached USD 30.688 billion in 2023, ranking second globally in terms of FDI inflows (UAE government website, 2024). Political stability, geographical location, developed infrastructure, stable currency, advanced financial system, and active government policies have contributed to attracting foreign investment (Alshamlan, Fernandez, & Fernandez, 2021). This has consequently strengthened international scientific exchanges, particularly at the level of higher education (David, 2024).

Saudi Arabia

Saudi Arabia is a country with a monarchical political structure and abundant oil and gas reserves. Due to energy price fluctuations, it is striving to diversify its economic structure within the framework of Vision 2030. In practice, the government has placed the creation of the “Knowledge Economic City” in Medina and the “Saudi Technology Zone” in Dammam on its agenda. According to Neffati and Jbir (2024), Saudi Arabia’s long-term development goals can be achieved through strengthening knowledge production, expanding Islamic tourism, and accelerating research in renewable energy sectors. As part of its structural economic reform, Saudi Arabia has implemented several strategic policy initiatives, including five-year national science, technology, and innovation policies, a national information technology program, and a national industrial

strategy. These policies have been operationalized through large-scale infrastructure projects such as the Knowledge Economic City in Medina and technology development zones in Dammam (Jawhar et al., 2022). In contrast to earlier development approaches, Vision 2030 has placed increasing emphasis on gender equality and women's empowerment, particularly in higher education, entrepreneurship, and digital commerce sectors (Alzamel, 2024; Alhawsawi & Jawhar, 2023). Technological investment has also strengthened the international competitiveness of Saudi small and medium-sized enterprises by facilitating their integration into global markets (Alqahtani et al., 2024). Furthermore, recent governmental initiatives aimed at economic diversification, technological transfer, and industrial modernization have significantly contributed to attracting foreign investment, reducing unemployment rates, and stimulating economic growth (Ehmaidat & Jajuga, 2023; Alkofahi, 2020). Despite substantial investment in educational expansion, the overall quality of the Saudi education system remains a critical concern. Structural reforms are required to enhance institutional performance, particularly within higher education, through strengthening innovation culture, improving university-industry collaboration, expanding interdisciplinary research, empowering academic staff, decentralizing decision-making processes, and encouraging broader civic participation within governance structures (Qahl & Sohaid, 2023).

Turkiye

Turkiye's geopolitical position as a strategic bridge between Asia and Europe has significantly influenced its scientific diplomacy and international policy orientation (Eshete, 2024). The country has increasingly utilized science diplomacy as a foreign policy instrument, particularly in its engagement with the European Union, leading to major reforms in national science, technology, and innovation policies (Karacan, 2021). To expand knowledge capacity, the Turkish government has prioritized educational system expansion, scientific infrastructure development, and rapid growth in the number of universities (Uslu et al., 2021). However, institutionalization of scientific collaboration within universities remains constrained by financial limitations, human resource shortages, and insufficient institutional autonomy (Oztunc et al., 2023). Furthermore, the rapid expansion of higher education without adequate alignment with labor market demands has contributed to rising graduate unemployment rates (Algul, 2024). Simultaneously, the effective utilization of domestically produced knowledge has been weakened by regional geopolitical instability, recurring internal economic crises, governance inefficiencies, and corruption within public institutions (Utku-Ismihan & Ismihan, 2024). These structural challenges have limited Turkiye's ability to translate knowledge growth into sustained increases in gross domestic product.

Another major challenge facing Turkiye is the increasing rate of brain drain. Official statistics indicate that the migration of highly skilled professionals increased by more than 50% between 2011 and 2020, reflecting structural deficiencies in domestic research opportunities and professional development pathways (Metin, 2023).

Iran

In pursuit of national development objectives, Iran has implemented multiple policy initiatives aimed at strengthening knowledge-based development indicators. Governmental support for university–industry collaboration, particularly through joint research and innovation projects, has contributed to economic development, inter-organizational cooperation, and increased value creation in manufacturing industries (Jamali Barkhordari, 2017). Additionally, legislative support for knowledge-based enterprises—including tax exemptions, low-interest financial loans, and specialized advisory services—has facilitated the growth of start-up ecosystems and technology-driven firms (Eshraghi et al., 2021). Employment-oriented initiatives that emphasize technical and vocational education aligned with labor market demands have also contributed to reducing unemployment rates, strengthening entrepreneurial capacity, and promoting the practical application of theoretical knowledge (Naderi Mahdi et al., 2021; Tamiz et al., 2023). Despite these supportive policy measures, structural weaknesses remain evident in cross-sectoral collaboration between the education system—particularly higher education—and industrial and labor market sectors (Miralikhani et al., 2009; Malekpour & Ghiasi Nadoshan, 2019). Declining research funding for higher education institutions has further constrained scientific productivity (Azimi, 2020). Moreover, political instability, including internal tensions and external geopolitical pressures, has significantly reduced foreign investment inflows and limited international research cooperation (Mohseni et al., 2020; Kozhanov, 2023). In addition to domestic constraints, limited international scientific engagement has reduced opportunities for knowledge transfer and technological diffusion. Empirical evidence indicates a declining trend in Iran’s international collaborative research output with advanced economies (Mehravar Gigloo & Khorsandi Taskouh, 2022). Furthermore, intensified economic sanctions have reduced access to international financial assistance, restricted technological transfer, and weakened academic and research cooperation networks (Saberpour et al., 2021). Therefore, the existence of a centralised system, the impact of US sanctions on access to advanced technology, and reduced foreign investment in education have forced Iran to rely solely on internal capabilities in knowledge production.

C) Juxtaposition

Quantitative data related to the various dimensions of academic, technological, and social knowledge growth, which reflect the relative standing of the selected countries (UNDP, 2023), are presented in the tables below. The assessment of whether a country's status is favourable or unfavourable is based on the evaluation criteria of the Global Knowledge Growth Index report. Accordingly, countries ranked 1 to 27 have a high level of knowledge growth, those ranked 28 to 97 have a medium level, and those ranked 97 to 133 have a weak level.

Table 1. Comparison of Academic Knowledge Growth Sub-indicators in Selected Countries Based on the 2023 Global Knowledge Index Report

Educational growth./ countries	UAE	Saudi Arabia	Turkiye	Iran
Government Expenditure on Higher Education	30/2	n/a	24/7	28/3
Enrollment Rates across Different Education Levels	10/1	23/7	42/6	30/6
Educational and Research Resources	40/4	68/1	22/9	68/9
Industry-University Collaboration	64/3	56	42/2	32
R & D	37/9	37/9	33/5	27/7
Citable Publications	59.1	69/9	26/5	39/2
Graduate Employment	81/4	74/1	68/5	44/9
academic freedom	12/1	6/2	8/4	8/3

Source: UNDP, 2023. The numbers in the tables represent each country's score for each indicator, out of 100.

In examining the educational sub-indicators, government expenditure on higher education and the state of R&D are not satisfactory in any of the selected countries, and low investment in this area cannot support sustainable economic goals. Furthermore, the level of academic freedom in these countries is very low, indicating a strong dependence of the education system on the political and ideological system. The UAE performs well in the indicators of graduate employability and industry-university collaboration, while Saudi Arabia performs well in terms of academic citation rates. Although research results show growth in publications in Turkey and Iran, the volume of publications and citable articles in Saudi Arabia has outperformed both countries in recent years. On the other hand, the abundance and percentage of educational and research resources – including faculty members, specialists, and researchers – in Iran is higher than in other countries, indicating the country's high human capital.

Table 2. Comparison of technological growth Sub-indicators in Selected Countries Based on the 2023 Global Knowledge Index Report

Technological Growth/ Countries	UAE	Saudi Arabia	Turkiye	Iran
Investment in Telecommunications Services	40/8	33/5	15/5	44/4
Coverage	66/3	58/9	61/8	61/7
Trade in Digitally Deliverable Services	38/5	21	18/4	12/1
Provision of Digital Services	90/1	82/2	86	42
Level of Access to Digital Services	72/5	76/2	38/8	38/1
Export of Advanced Technology	31	17/3	20/4	11/7

Source: UNDP, 2023

Table 2 shows technological knowledge growth in the selected countries. The UAE's overall performance in the technology growth index is higher than that of the other selected countries, but it still lags behind advanced countries in terms of high-technology exports. Saudi Arabia is competing with the UAE in these sub-indicators, but it has performed better than the UAE in access to digital services. Iran's status in this sub-indicator is lower than the other three countries (particularly in high-technology exports).

Table 3. Sub-indicators of Social and Political Supportive Environment in Selected Countries Based on the 2023 Global Knowledge Index Report

Socio-political Growth/ Countries	UAE	Saudi Arabia	Turkiye	Iran
Political Environment	70/3	19/9	13/7	8/6
Governance	64	42	28/5	12/6
Rule of Law	83/5	63/7	34/9	14/2
Control of Corruption	88/7	70/8	43/9	18/4
Gender Equality	86/8	53/3	54/5	42/3
Health and Healthcare	84	79/2	84	80
Environmental Performance	29/3	41/6	43/4	36/8

Source: UNDP, 2023

Table 3 presents the performance of the selected countries in terms of the socio-political environment supporting knowledge growth. The United Arab Emirates demonstrates significantly stronger performance in political stability, governance quality, corruption control, and rule of law, all of which are critical factors in attracting foreign investment, compared with Saudi Arabia, Turkiye, and Iran. In Turkiye and Iran, governance quality ranks lower relative to other sub-indicators. Overall, Iran's socio-political environment appears to provide limited support for innovation development and knowledge-based growth.

D) Comparison

To address the research questions regarding the similarities and differences in knowledge growth indicators among the UAE, Saudi Arabia, Turkey, and Iran, the results of the data analysis are presented in the table below.

Table 4. Similarities and Differences of the UAE, Saudi Arabia, Turkey and Iran in Various Aspects of Knowledge Growth

Knowledge Dimensions / Countries	Indicators	UAE	Saudi Arabia	Turkiye	Iran
Academic Knowledge Growth	Expenditure level	Medium	-	Medium	Medium
	Academic freedom	Low	Low	Low	Low
	Educational and research resources	Low	Medium	Low	Medium
	Industry-university collaboration	High	Medium	Medium	Low
	R&D	Medium	Medium	Medium	Medium
	Academic citation	High	High	Medium	Medium
	Graduate employability	Medium	Medium	Low	Low
Technological Knowledge Growth	investment in telecommunication services	Medium	Medium	Low	Medium
	Coverage level	Medium	Medium	Medium	Medium
	E-commerce	Medium	Medium	Low	Low
	Provision of digital services	High	Medium	Medium	Low
	Access to digital services	High	High	Medium	Medium
	High-tech exports	Low	Low	Low	Low
Social Knowledge Growth	Political environment	Medium	Low	Low	Low
	Governance	Medium	Medium	Low	Low
	Rule of law	Medium	Medium	Medium	Low
	Control of corruption	Medium	Medium	Medium	Low
	Gender equality	High	Medium	Medium	Medium
	Healthcare	Medium	Medium	Medium	Medium
	Environmental performance	Low	Low	Low	Low

Table 4 shows similarities among the selected countries in six indicators: government investment in higher education, academic freedom, internet coverage, high-technology exports, healthcare, and environmental performance. Iran and Saudi Arabia have similar conditions in terms

of educational and research resources, while Iran and Turkey are relatively similar in five indicators: academic citations, graduate employability, online commerce, access to digital services, and governance. Furthermore, Iran has shown weaker performance than the other selected countries in four indicators – industry-university collaboration, digital service provision, rule of law, and corruption control – whereas the UAE outperforms the other countries in four social growth indicators: political environment, rule of law, corruption control, and gender equality.

Table 5. Similar and Divergent Knowledge Growth Indicators in the UAE, Saudi Arabia, Turkey and Iran

Knowledge Dimensions		Indicators	
Academic Knowledge Growth	Similarities	<ul style="list-style-type: none"> - Low cost of higher education compared to other educational levels - Low level of academic freedom 	
	Differente	<ul style="list-style-type: none"> - Focus and methods of investment in higher education (the UAE emphasizes internationalization in higher education; Saudi Arabia emphasizes gender equality; Iran and Turkey emphasize quantitative expansion and publication of articles) - Weak industry–university cooperation in Iran - High educational and research resources in Iran 	
Technological Knowledge Growth	Similarities	<ul style="list-style-type: none"> - Low investment in telecommunications services - Weak trade in digitally deliverable services - Poor performance in high-tech exports - Good internet coverage 	
	Differente	<ul style="list-style-type: none"> - Low provision and accessibility of online public and private sector services in Iran 	
Social Knowledge Growth	Similarities	<ul style="list-style-type: none"> - Good performance of all countries in healthcare - Weak environmental performance of citizens 	
	Differences	<ul style="list-style-type: none"> - Stable political environment and good governance in the UAE - Supportive and effective governance in the UAE - Weak rule of law in Iran - Low corruption control in Iran and Turkey 	

Based on the analysis of the findings, all four countries regard higher education as an important instrument for achieving academic knowledge growth, economic transformation, and strengthening human capital, and have designed numerous programmes to develop educational and research centres. The UAE, relying on an internationalisation-oriented approach to higher education, seeks to establish branches of the world's top universities and build academic cities, and has also offered numerous scholarships for faculty and student exchanges with advanced countries through the expansion of scientific relations. Saudi Arabia, while emphasising the reduction of the

scientific gap with regional countries, is striving to achieve gender equality goals. The findings show that Iran holds a high position in terms of university network development and scientific article production, especially in basic sciences and engineering, but faces serious challenges in the application of sciences due to weak industry-university collaboration, international restrictions arising from sanctions, and a lack of research funding. Turkey, despite emphasizing the quantitative expansion of higher education and increasing scientific output, has faced a decline in educational quality in recent years due to economic fluctuations and brain drain.

Furthermore, all selected countries scored relatively low in academic freedom. Evidence from existing studies suggests that centralized monarchical governance structures in Saudi Arabia and the UAE, along with extensive governmental influence over higher education policymaking, have constrained institutional autonomy. In Turkey, direct political intervention in higher education and the erosion of university independence have contributed to reduced academic freedom. In Iran, strict monitoring of curricular content and the adoption of ideologically oriented educational approaches have also negatively affected academic independence, collectively contributing to lower global rankings in academic freedom indicators.

Regarding technological knowledge growth, all four countries demonstrate moderate performance in telecommunications service investment and trade in digitally deliverable services. However, internet penetration rates across the selected countries remain relatively high. These countries have prioritized expanding e-government services and strengthening online commercial platforms. Among them, the UAE, through extensive investment in six domains of digital services as part of its smart city plans, has achieved a high position in technological knowledge. Saudi Arabia, as a transitioning economy, has primarily focused on attracting foreign technological expertise while simultaneously expanding digital service accessibility compared with previous decades. Turkey and Iran have likewise emphasized the expansion of online services and incorporated digital governance into their policy agendas. Despite these efforts, all four countries remain in the early stages of developing advanced technology export capabilities.

In terms of the socio-political environment supporting knowledge growth, all four countries face challenges associated with regional geopolitical tensions and concentrated political authority, which have contributed to weaknesses in political stability and governance quality. The UAE has sought to achieve relative stability by adopting a non-ideological approach and avoiding direct intervention in regional affairs. Saudi Arabia, due to the suppression of dissent; Turkey, owing to power concentration and internal tensions with opposition parties; and Iran, because of social protests and external pressures, have received low scores in the indicators of political stability and

social legitimacy. Moreover, corruption control in these countries is closely linked to concentrated political power and economic regulatory frameworks. The absence of transparent financial regulations, the persistence of systemic administrative corruption, and the influence of elite political networks have collectively created a significant gap between these countries and global leaders in corruption control. The prevalence of corruption and limited institutional capacity to mitigate it have intensified social inequality and hindered efforts to achieve sustainable societal development. Nevertheless, the UAE has demonstrated relatively stronger performance in this area through the implementation of more transparent fiscal and regulatory policies.

4. Conclusion

The present study aimed to analyze the factors influencing academic, technological, and social knowledge growth in the United Arab Emirates, Saudi Arabia, Turkey, and Iran. Despite their substantial energy resources, these countries have adopted strategic policies to reduce their dependence on oil revenues by strengthening educational systems, enhancing human capital development, and supporting knowledge-based enterprises and research and development institutions. The findings indicate that the selected countries have not demonstrated satisfactory performance in higher education quality and academic freedom indicators. Although several previous studies have highlighted significant investments in higher education within these countries, consistent with the results of the present study, the effective utilization and commercialization of university-generated knowledge remain limited, and higher education systems continue to face structural challenges.

The United Arab Emirates has attempted to enhance educational quality by establishing international branches of globally recognized universities. However, some scholars argue that this approach has contributed to reduced confidence in domestic human capital and increased reliance on foreign labor. These findings align with the studies of Pereverzyeva (2024) and Alhouti (2023). Similarly, Turkey and Iran have primarily focused on quantitative expansion of universities and increasing student enrollment capacity. Nevertheless, the contribution of knowledge production to gross domestic product remains relatively low, and commercialization processes face substantial barriers due to weak university–industry collaboration and declining international academic engagement. Moreover, issues such as brain drain and graduate unemployment continue to represent major structural challenges in both countries, consistent with findings reported by Malekpour Lapari and Ghiassi Nodoshan (2019) and Metin (2023).

Furthermore, all examined countries demonstrated relatively weak performance in academic freedom indicators. As emphasized by Taherdoost et al. (2025) and Izadi et al. (2022),

academic freedom, as an outcome of democratic governance structures, plays a fundamental role in preserving higher education autonomy and promoting international scientific collaboration. Therefore, maintaining institutional independence, supporting freedom of expression and intellectual inquiry, and reducing financial dependence of universities on governmental funding can significantly enhance higher education quality and strengthen human capital competencies. The findings of Puska, Hodzic, and Stilic (2023) further indicate that improving the quality of higher education institutions, particularly in human capital development, contributes to raising public awareness, addressing environmental, social, and economic challenges, and empowering societies toward sustainable development.

With regard to technological knowledge growth, the findings reveal that the United Arab Emirates has successfully positioned itself to compete with advanced economies in knowledge-based economic transformation. The country has implemented major initiatives in research and development, information and communication technologies, and smart city development, resulting in significant progress in digital service accessibility. These results are consistent with the findings of Algozell et al. (2024), which highlight the UAE's role in promoting sustainable urban development in desert environments, addressing water scarcity challenges, and implementing renewable energy projects. Further analysis suggests that by strengthening technological knowledge growth indicators, the UAE has advanced toward achieving the UNESCO Sustainable Development Goals 2030, as supported by Baysharova et al. (2025).

In contrast, Turkey and Iran have implemented policies aimed at expanding internet coverage across wider geographic areas and improving access to online services. However, the technological sector in these countries remains relatively nascent, and substantial gaps persist in advanced technology exports and digital service development compared with industrialized economies. Even in the UAE, many large-scale technological projects rely more heavily on technology imports than on domestic technological exports. These countries remain among the world's leading exporters of oil and gas, and only a limited portion of national budgets is allocated to technological export development. The findings of Opeyemi Akinwale and Surujlal (2021) similarly demonstrate that large technological initiatives in Saudi Arabia remain heavily dependent on oil-sector corporations. Additionally, studies by PourEzzat et al. (2010) and Akkus (2024) indicate that the contribution of knowledge-based companies to national revenues in Iran and Turkey remains significantly lower than oil-generated income. Continued dependence on fossil fuel revenues, particularly in the context of international sanctions and geopolitical pressures, remains a major obstacle to sustainable economic diversification. To enhance technological growth, these

countries should not only strengthen digital infrastructure but also invest strategically in digital skills education, regulatory frameworks supporting business registration, intellectual property protection, tax incentive programs, export market development, and the implementation of applied technological projects in sectors such as healthcare, education, and public services.

Finally, analysis of socio-political environment indicators demonstrates that social knowledge growth in all four countries has been influenced by regional geopolitical instability and centralized decision-making structures, leading to lower rankings in political stability and governance indicators. Nevertheless, the UAE has attempted to foster favorable socio-political conditions by minimizing direct involvement in regional military conflicts and adopting relatively pragmatic and non-ideological governance approaches. According to the findings of this study and the perspectives of several scholars (Alshamlan et al., 2021; Shadab & Elm, 2024), the UAE's progress in these areas is largely attributed to international scientific exchange, technology transfer, economic stability, political continuity, and soft diplomacy strategies. These factors have not only strengthened innovation and knowledge development but have also enhanced the country's attractiveness for foreign investment.

The UNDP Global Knowledge Index Report (2023) similarly emphasizes that governance weaknesses, political instability, and ineffective corruption control constitute major factors contributing to the relatively low rankings of Saudi Arabia, Turkey, and Iran in establishing supportive social environments for knowledge development. Moving toward more inclusive governance strategies, strengthening civil rights protections, improving transparency through regulatory and reporting systems, enhancing international technological collaboration, increasing governmental accountability, and rebuilding public trust may enable these countries to address socio-political challenges, foster sustainable societies, and advance knowledge-based economic development.

Based on the analysis of the research findings, and with the aim of enhancing various dimensions of knowledge growth indicators, the following recommendations are offered to the science and technology policy-making centers, as well as the research and academic institutions of these countries:

Academic Knowledge Growth

- Iran and Turkey are recommended to revise educational regulations through collaboration with industry and chambers of commerce to better align academic programs with labor market demands.

- All four countries are encouraged to integrate employment-oriented projects into academic curricula through university–industry partnerships, particularly in countries experiencing high graduate unemployment rates.
- Strengthening institutional collaboration between private sector organizations and higher education institutions through joint research projects, internship programs, and knowledge transfer initiatives is recommended across all selected countries.
- Given Iran’s relatively strong human capital and research resources, it is recommended that academic experts, researchers, and university faculty members play more active advisory roles in governmental and strategic policymaking institutions.
- Organizing international scientific workshops, conferences, and collaborative research events aimed at promoting regional sustainable development is strongly recommended.

Technological Knowledge Growth

- Providing financial and advisory support for innovation and research and development activities, including the establishment of innovation hubs, accelerators, and startup incubation centers, particularly in Iran.
- Expanding equitable access to digital services through investment in digital infrastructure, affordable internet accessibility, and enhancement of digital literacy among citizens, especially in Iran and Turkey.
- Facilitating advanced technology trade through customs simplification, tariff reductions, and regulatory reforms across all four countries.
- Developing integrated governmental digital service platforms, particularly in Iran, to enhance public service delivery efficiency.
- Establishing regional innovation centers focused on emerging technologies.

Social Knowledge Growth

- Developing transparent governmental financial monitoring systems to record public expenditures and provide regular public reporting, particularly in Saudi Arabia, Turkey, and Iran.
- Establishing independent regulatory and supervisory institutions with legal authority to investigate structural and administrative corruption across all four countries.
- Enforcing anti-corruption laws equitably across all societal groups, especially in Iran and Turkey.

- Promoting diplomatic dialogue and regional conflict resolution strategies to enhance independent decision-making processes and reduce external geopolitical influence.
- Strengthening regional cooperation aimed at reducing military conflicts and fostering sustainable development.

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