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Drivers and barriers to ICT sector development in the Gulf Cooperation Council: A policy-oriented analysis

Mona Massalha
Social Sciences Department, Arab American University, Ramallah, Palestine.
Email: monaelinat@gmail.com

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ABSTRACT

Information and communication technology (ICT) now underpins every primary diversification strategy in the Gulf region; however, the policy frameworks supporting it remain uneven. Drawing on qualitative content analysis of 68 national strategies, laws, and performance reports, supplemented by five multilateral briefs (2010–2024), this comparative study identifies the principal forces accelerating or hindering ICT development across the six Gulf Cooperation Council (GCC) states. It examines how government-led agendas, institutional designs, foreign direct investment, and human capital formation interact to shape nations' digital trajectories. The study finds that state-driven innovation models have delivered world-class infrastructure: Qatar, for example, ranked third worldwide in the 2023 ICT Development Index. However, persistent skill shortages, institutional rigidity, and modest private-sector participation continue to constrain the sector's long-term sustainability. By juxtaposing national reforms with international benchmarks, the study reveals convergences (e.g., aggressive 5G rollouts) and divergences (e.g., data governance regimes and depth of venture capital) in the GCC's policy mix. These patterns are categorized into region-wide and country-specific policy paths that can facilitate a more resilient, innovation-led digital economy in the Gulf. The findings contribute to the broader debate on technological modernization in rentier states, helping identify the conditions wherein top-down investment can be reconciled with bottom-up innovation to secure sustainable, knowledge-based growth.

Contribution/ Originality: This study contributes to the existing literature by introducing a policy-oriented framework for analyzing ICT development in the GCC. It conceptualizes the interplay between national strategies, foreign investment, human capital, private-sector engagement, and local innovation ecosystems, proposing a "sovereign quadrant" model suited to digital transformation in resource-rich, nondemocratic contexts.

1. INTRODUCTION

In recent years, information and communication technology (ICT) has emerged as a prominent and engaging field for scholars, academics, and policymakers. ICT is increasingly serving as a foundational driver of social and economic development across developed and developing nations (Nour, 2011; Selwyn, 2004).

The World Bank and the Organization for Economic Co-operation and Development (OECD) have established various frameworks for evaluating the progress of knowledge-based economies. The key drivers of such economies include strategic investments in education at all levels, research and development with a focus on capacity-building and collaborative initiatives, entrepreneurship, and access to diverse financing sources such as seed funding, angel investors, and venture capital. The development of science parks, business incubators, and mechanisms for commercializing proven technologies serve as additional enablers (Chen & Dahlman, 2005; OECD, 2001).

However, these investments are not sufficient on their own. For meaningful results, they need to be supported by a stable macroeconomic environment, a well-functioning innovation ecosystem, and a business-friendly climate grounded in transparent regulatory frameworks. These elements are essential for attracting investment from the private sector, including foreign direct investment, which plays a vital role in facilitating technology transfer, generating spillover benefits, and promoting knowledge-based economic growth (Tadros, 2015).

The advancement of the ICT sector in the Gulf Cooperation Council (GCC), comprising the United Arab Emirates, Saudi Arabia, Qatar, Bahrain, Kuwait, and Oman, has played a pivotal role in the region's broader efforts toward economic diversification and modernization (Alshubiri, Jamil, & Elheddad, 2019). As these countries seek to reduce their dependence on hydrocarbon revenues, they have placed the ICT sector as the cornerstone for the realization of their long-term strategic vision, exemplified by Saudi Vision 2030, UAE Centennial 2071, and Qatar National Vision 2030. However, the trajectory of the ICT sector's development in the GCC is marked by divergence, driven by a range of enabling and constraining factors.

Despite having similar political and economic frameworks, the speed and characteristics of technological advancement in the GCC exhibit notable differences, influenced by several factors, including policy direction, institutional capacity, and the extent of international engagement. A defining feature across the region is top-down, state-led development models (Albous, Al-Jayyousi, & Stephens, 2025; Karimi, 2017; Pătru, 2011) in which governments play a pivotal role in shaping innovation and prioritizing sectoral development. Traditionally, the GCC has depended on imported technologies; however, a notable shift is currently underway, characterized by substantial investments into local innovation. This transformation has been particularly evident in the ICT sector, which has experienced rapid growth, propelled by proactive government initiatives and increased private-sector participation. Nevertheless, challenges persist, including a shortage of specialized human capital and underdeveloped research ecosystems. In response, the governments in the GCC have focused on strategies to attract global expertise and foster local talent to enhance their digital economies.

International benchmarks have highlighted the remarkable progress in ICT development in the Gulf region. For instance, Qatar achieved third place in the ICT Development Index (IDI) 2023 (2024), with a score of 97.3 out of 100, highlighting its superior digital infrastructure and connectivity. Meanwhile, Saudi Arabia ranked sixth in the United Nations E-Government Development Index 2024 (2025). These rankings reflect the GCC's competitiveness within the global ICT landscape.

By 2024, the ICT sector in the GCC is anticipated to reach a total value of USD 129.07 billion, with a projected increase to USD 203.09 billion by 2029. This growth corresponds to a compound annual growth rate of 9.49% (Mordor, 2025) and is driven by a combination of domestic initiatives and international collaborations, underscoring the sector's maturity.

For example, in Saudi Arabia, the ICT sector is vital to the goals outlined in Saudi Vision 2030, which seeks to reduce the nation's dependence on oil and foster sustainable development. Key initiatives include promoting entrepreneurship, leveraging advanced technological infrastructure such as 5G networks, strengthening cybersecurity, and developing the NEOM project as a global innovation hub. Furthermore, significant investments are being made in education and workforce development. These efforts aim to create a supportive environment for innovation and entrepreneurship, thereby establishing a solid foundation for the ICT sector's long-term growth (Al-Shami, 2024).

Across the GCC, the use of ICT has led to the development of new business opportunities in areas such as smart cities, online government services, healthcare, cars, and energy. For example, many factories have begun using robots and advanced technology to improve manufacturing, and stores are using Internet-driven devices to better engage with customers and ensure smooth operations. To foster these innovations, governments have set up special technology parks, such as Dubai Internet City, Qatar Science & Technology Park, Knowledge Oasis Muscat, and

King Abdullah Bin Abdulaziz Science Park. These parks serve as centers for creativity and help meet local and global needs (Ericsson, 2024a, 2024b).

ICT plays a pivotal role in enabling individuals, governments, and organizations to transform information into actionable knowledge, thereby serving as a key driver of lasting economic and social transformation. Organizations can harness the potential of ICT by strategically deploying well-designed systems and development programs to drive economic growth (Zwass, 1996).

As GCC governments have increasingly prioritized digital transformation, the ICT sector has been positioned as the cornerstone of their economic diversification strategies. However, scholarly work on the intersection of rentier governance, institutional capacity, and foreign investment in ICT development within the region remains limited. To address this gap, this study provides a comparative, policy-oriented analysis of ICT strategies in the GCC, offering actionable insights into structural barriers and policy innovations. The findings are particularly relevant for decision-makers, international development agencies, and scholars of digital governance in nondemocratic contexts.

Despite substantial investments and clear strategic visions, the development of the ICT sector in the GCC remains constrained by institutional fragmentation, reliance on foreign expertise, and limited local innovation. While digital infrastructure is rapidly advancing, questions remain regarding the long-term sustainability of the top-down transformation model and the extent to which local capacities are being meaningfully developed. Therefore, this study aims to assess these dynamics across the GCC countries.

A review of the literature reveals that scholarship on the ICT sector in the GCC remains dominated by single-country case studies or coarse macro-level statistics, leaving four key gaps. First, the impact of the region's rentier governance model in reconfiguring the balance among state capital, foreign investment, and indigenous entrepreneurship remains poorly understood. Second, it remains unclear whether the top-down digital mega-projects implemented in this region translate into durable, home-grown innovation capacity once the initial infrastructure is in place. Third, the literature provides only a cursory examination of how the Sino–US technostrategic rivalry has reshaped national choices regarding digital infrastructure. Finally, there is virtually no comparative, systematic exploration of the fundamental constraints and drivers of ICT development across GCC states, which hampers evidence-based policymaking aimed at accelerating the region's digital transformation.

In this context, this study adopts a qualitative, cross-case comparative design to examine the institutional and political determinants shaping ICT trajectories in the GCC. Drawing on national strategies, legislative texts, and multilateral reports published between 2010 and 2024, it aims to address three questions: (i) what institutional, political, and economic factors most decisively influence sectoral outcomes; (ii) how and why national strategies in the GCC diverge in scope, implementation mechanisms, and impact; and (iii) what is the extent of the integration of local innovation and human capital into state-driven digital agendas. Grounded in political economy and innovation systems theories, this study advances two propositions. First, state-led models enable rapid infrastructure deployment but constrain bottom-up innovation. Second, more diversified, networked institutional architectures foster more sustainable digital ecosystems. Therefore, this study extends the classic "triple helix" model (academia, industry, and government) to propose a "sovereign–quadrant" framework adapted to resource-rich, nondemocratic contexts, incorporating sovereign wealth funds as a fourth pillar.

This study aims to identify the factors that enable and constrain the ICT sector across the six GCC member countries, compare the effectiveness of their implementation tools, and formulate policy recommendations that support resilient, locally embedded digital economies. While it relies on secondary sources that may overstate aspirations relative to practice and does not conduct a quantitative impact assessment, its methodological triangulation and cross-national perspective provide a context-rich evaluation of the gap between strategic intent and operational reality. The study contributes to wider debates on how rentier states can foster knowledge-driven growth while addressing the inherent structural and geoeconomic vulnerabilities in externally fueled modernization.

2. LITERATURE REVIEW AND THEORETICAL FRAMEWORK

ICT refers to the integration of computing and telecommunications systems for effective data management and service delivery (Lunenburg, 2010; Oxford University Press, 2021). Its strategic role in transforming economic and social transformation is well-established (AlFoul & Nayel, 2022; Nour & Satti, 2002; Zwass, 1996). However, while investments in digital infrastructure have accelerated modernization in the GCC, sectoral outcomes remain uneven (Belloumi & Touati, 2022).

The literature has identified government policy (Karimi, 2017; Zerdoudi & Kouadria, 2021), foreign investment (Mohammed & Abdel-Gadir, 2023), and human capital (Rehman & Yuan, 2025) as central factors for ICT development in the region, and state-led initiatives and foreign partnerships have enabled infrastructure growth (Alraja, Hammami, & Al Samman, 2016). However, structural challenges, including skills shortages (Nour, 2013), institutional inertia, and gender disparities (Mosly, 2023), continue to constrain innovation ecosystems (Al-Khalifa, Al-Jayyousi, Mamlook, & Aldhmour, 2021; Thafer, 2023).

National strategies, such as Saudi Vision 2030 and UAE Centennial 2071, function as developmental frameworks and tools for securing political legitimacy through modernization (Khan & Iqbal, 2020; Olver-Ellis, 2020). Regulatory efficiency remains critical: streamlined bureaucracies attract capital investment (Katz & Jung, 2021) while alignment with global standards strengthens telecom infrastructure.

Foreign direct investment (FDI) plays a pivotal role in technology transfer and development (Leitão & Baptista, 2011; Xu & Sheng, 2012). In the GCC, its impact is amplified through joint ventures (Chhabra, Verma, & Giri, 2025; Tahat & Whelan, 2015). Nonetheless, translating investments into infrastructure into increased productivity depends on the presence of complementary reforms, including talent development and governance enhancement (Jia, Xie, & Wang, 2023; Ngwenyama & Morawczynski, 2009; Tassey, 2008). Despite having developed an advanced ICT infrastructure, the region's socioeconomic gains remain limited (Vodanovich, Urquhart, & Shakir, 2010). Specifically, a misalignment between education and labor market needs, shortages of specialized skills, and limited public awareness (Al-Maliki, 2013; Sengupta & Garg, 2024) lead to continued dependence on expatriate labor, driving up costs and delaying implementation.

A conducive business environment, marked by regulatory transparency, financial access, and venture capital, is essential for fostering local entrepreneurship (Tadros, 2015). Entrepreneurial development is shaped by individual capabilities and institutional conditions (Głodowska, Pera, & Wach, 2016; Wach & Głodowska, 2021), and robust ecosystems that promote creativity and innovation are seen as critical enablers (Khan, 2016; Lane, 2016).

Sociopolitical constraints, including restricted academic freedom, a segmented labor market, and weak entrepreneurial cultures, continue to impede innovation in the region (Ben Hassen, 2020; Sellami, Arar, & Sawalhi, 2022). However, the emergence of grassroots tech initiatives and youth-led startups in cities such as Dubai and Doha signals the growing potential for bottom-up transformation.

This study applies rentier state theory and the innovation systems framework to examine how ICT development in the GCC intersects with centralized governance, global integration, and the gradual development of local capabilities.

3. RESEARCH METHOD

This study employs a qualitative, multiple-case comparative design to examine the evolution of the ICT sector across six members of the GCC: Saudi Arabia, the United Arab Emirates, Qatar, Bahrain, Kuwait, and Oman. The study relies exclusively on documentary evidence issued by national authorities and reputable international organizations and follows rigorous procedures to ensure transparency, reliability, and analytic depth.

Primary materials were sourced electronically from official government portals, including ministries, regulatory authorities, and open data platforms, as well as international databases such as the International Telecommunication Union (ITU), the World Bank, and the Arab Monetary Fund. Documents were screened using four criteria: (i)

institutional provenance, (ii) legal status (law, bylaw, or official performance report), (iii) public accessibility, and (iv) publication between 2010 and 2024. These criteria ensured the materials were relevant and traceable. This process yielded 68 primary texts, comprising strategies, laws, and performance reports, supplemented by 5 key regional or international reports.

A structured codebook with five theoretically derived categories guided the analysis. These categories reflected core drivers of the Gulf digital economy: investment (public spending and FDI), workforce (size and composition of technical talent), local initiatives (incubators, innovation funds, accelerators), and trade flows (digital imports and exports). Coding was performed by the principal researcher to maintain consistency, with iterative internal reviews conducted to verify accuracy and minimize bias.

The coded data were organized into a two-dimensional matrix (country × variable), enabling systematic cross-case comparisons and the identification of shared patterns and structural divergences. National digital strategies were further disaggregated to extract quantitative targets (e.g., 100% 5G coverage; digital economy's share in the gross domestic product [GDP]) and implementation instruments (e.g., oversight bodies, funding mechanisms). These targets were then matched against government performance reports from 2010 to 2024, focusing particularly on the 2019–2024 period, to evaluate the disparities between policy objectives and realized outcomes.

To ensure validity and reliability, the study triangulated three data sources (official documents, international databases, and performance reports) and documented each analytical decision through a methodological audit trail. Two key limitations remain: (i) incomplete time-series data on technology sector investments and workforce metrics in several states, particularly Bahrain and Kuwait, and (ii) irregular publication cycles for performance reports. These limitations were mitigated by consulting supplementary ITU estimates, multilateral datasets, and running sensitivity tests to assess the robustness of the results.

This methodology provides a transparent, replicable framework that links formal digital mandates to observable outcomes across the GCC. This framework offers a foundation for future studies incorporating additional qualitative variables, such as governance quality or geopolitical risk, to make the analysis more detailed and comprehensive, and thus better guide policymakers.

4. FINDINGS

The analysis reveals several key drivers and barriers to ICT sector development in the GCC.

4.1. Policy Instruments

Advancing the ICT sector in the GCC requires integrated, multifaceted policy frameworks. Key priorities include expanding telecommunications networks, increasing and improving Internet access, and ensuring service affordability relative to income. Equally essential are robust legal and regulatory frameworks that cover market liberalization, intellectual property rights, electronic transactions, and cybersecurity. A further critical component is aligning education with labor market demands through curricular reform and providing targeted training for youth and recent graduates to build local capabilities. These efforts must be supported by cross-sector collaborations and the establishment of regional centers of excellence. Additionally, private-sector engagement and foreign investment must be emphasized to drive innovation and strengthen regional competitiveness (Arab Monetary Fund, 2008).

Government visions and policies are the primary drivers of digital transformation across the GCC. All six states have embedded ICT into their national strategies, operationalized through dedicated budgets, regulatory bodies, and legislative reform.

Saudi Arabia exemplifies a top-down, policy-driven model. Programs such as the Government of the Kingdom of Saudi Arabia (2016) and Vision 2030 (2016) have institutionalized ICT development through entities such as the Communications, Space and Technology Commission. Legal foundations include the Government of the Kingdom of Saudi Arabia (2001), the Kingdom of Saudi Arabia (2007), the Digital Government Authority (2021), and the Saudi

Data and AI Authority (2019). These bodies regulate compliance, guide artificial intelligence (AI) adoption, and oversee digital service delivery. Complementary initiatives promote entrepreneurship and digital skills via state-funded incubators and coding academies.

Meanwhile, the United Arab Emirates (UAE) demonstrates a highly centralized, innovation-driven approach. Its strategy is anchored in UAE Vision 2021 (2010), UAE Centennial 2071 (2021), the United Arab Emirates Government (2019), and the Digital Government Strategy 2022–2026 (2021). Implementation is overseen by agencies such as the Telecommunications and Digital Government Regulatory Authority (TDRA), established in 2003, the Artificial Intelligence Office, founded in 2017, and the UAE Council for Digital Economy, created in 2022. Key legislations include Federal Decree-Law No. 46 of 2021 on Electronic Transactions and Trust Services (2021), along with cloud-first strategies and open data regulations. Moreover, the UAE was the first country in the region to establish a ministerial portfolio for AI, integrating advanced technologies across sectors.

Qatar aligns its digital priorities with its long-term goals presented in the General Secretariat for Development Planning – Qatar (2008). These objectives are operationalized through various instruments, including the Qatar Digital Government 2020 Strategy (2014–2020), the Qatar Digital Agenda 2030 (2024), and the NextGen Strategy (2023). Oversight is provided by the Ministry of Communications and Information Technology and the Qatar Communications Regulatory Authority (CRA). Legal milestones include the Cybercrime Prevention Law (2014), the Kingdom of Saudi Arabia (2016), and the Electronic Commerce and Transactions Law No. 16 (2010). Qatar's digital agenda is reinforced by enterprise partnerships with Microsoft, Oracle, Adobe, and IBM, reflecting a blend of global collaboration and domestic capacity-building.

Oman's digital transformation is framed by Vision 2040 (2020) and operationalized through the eOman strategy (2011) and the National Digital Transformation Program 2021–2025 (2021). Key regulatory entities include the Telecommunications Regulatory Authority and the Ministry of Transport, Communications, and Information Technology. Oman's initiatives focus on cloud infrastructure, e-payment systems, and the rollout of a national broadband. Recent legislation on data protection and cybersecurity has supported a strategic shift toward software development and digital services, underpinned by growing hardware imports and public–private partnerships aimed at building a digital society (Ministry of Transport, Communications and Information Technology, 2024).

Bahrain's forward-looking policies reflect its aspirations to become a digital innovation hub. Under Bahrain's Economic Vision 2030 (2008) and Telecommunications, ICT, and Digital Economy Sector Strategy (2022–2026) (2022), the country has promoted private-sector participation, liberalized telecom markets through the Telecommunications Regulatory Authority (TRA), and implemented modern legislation, including the Personal Data Protection Law (2018) and the Information & eGovernment Authority – Kingdom of Bahrain (2017). Bahrain's openness to international partnerships, such as Amazon Web Services' (AWS) regional hub in Manama, and its legal reforms allowing 100% foreign ownership in the ICT sector, have attracted high levels of FDI. The strategy emphasizes AI integration, public–private partnerships, and improved digital public services.

Finally, Kuwait's digital development has evolved within the framework of Kuwait Vision 2035 (2017) and the National ICT Strategy 2021–2025 (2021).

The Central Agency for Information Technology and the Communication and Information Technology Regulatory Authority have led ICT initiatives focused on 5G deployment, digital governance, and the modernization of e-government services. The policy mix includes investments in fiber-optic infrastructure and regulatory measures related to data protection, e-commerce, and cybersecurity. While implementation is constrained by bureaucratic inefficiencies and low private-sector involvement, strategic collaborations and legal modernization are underway to enhance Kuwait's digital capacity.

Table 1 presents similarities and differences among the six GCC countries.

Table 1. Comparative overview of ICT strategies in GCC countries.

Country	National Strategy	Key Pillars	Major Achievements	Challenges
Saudi Arabia	Vision 2030, National Transformation Program, Saudi Data and AI Authority (SDAIA) Strategy	Digital government Artificial intelligence Smart cities	Widespread 5G deployment, Mega-projects such as NEOM Establishment of SDAIA Enhanced cybersecurity framework	Shortage in local ICT talent Bureaucratic inertia Challenges in technology localization
United Arab Emirates	UAE Vision 2021, UAE Digital Government Strategy 2021–2025, UAE Centennial 2071	Artificial intelligence Blockchain Public–private partnerships	Ministry of AI established Regional leader in digital public services Host to major global tech firms	Digital divide across regions Reliance on foreign expertise Innovation sustainability
Qatar	Qatar National Vision 2030, Qatar Digital Agenda 2030, Qatar e-Government 2020 Strategy	Smart infrastructure Digital economy International co-operation	Ranked third globally in the ICT Development Index Smart city initiatives Robust support for digital entrepreneurship	Heavy reliance on FDI Limited availability of domestic high-tech talent
Oman	eOman Strategy, National Digital Transformation Strategy 2025, Oman Vision 2040 Implementation Follow-up Unit	E-government services National skills development Business environment reform	Creation of the Ministry of Transport, Communications, and IT Digitization of public services Launch of unified e-portals	Funding constraints Institutional resistance to change Weak domestic innovation ecosystem
Bahrain	Bahrain Vision 2030, Cloud-First Policy, Telecommunications, ICT, and Digital Economy Sector Strategy 2022–2026	Cybersecurity Digital entrepreneurship Regulatory innovation	First GCC nation to adopt the cloud-first policy Attracted global firms (e.g., AWS) Advanced legal and regulatory frameworks	Limited market size Regional competition Shortage of skilled digital professionals
Kuwait	Kuwait Vision 2035, Kuwait National ICT Strategy 2021–2025	E-government Data security Infrastructure modernization	Modernization of online public services Updated infrastructure Cybersecurity and data governance initiatives	Low private-sector participation Administrative delays Slow implementation of ICT reforms

However, while all GCC countries have exhibited their political will to advance the ICT sector, the success of implementation has varied. The UAE and Saudi Arabia exhibit firm top-down steering, characterized by robust institutional coordination and legal foresight.

Meanwhile, Qatar and Bahrain have developed advanced digital ecosystems, but they operate on different scales and have varied international outreach. Finally, Oman and Kuwait demonstrate growing commitment but are constrained by structural and institutional limitations.

Notably, Bahrain and Qatar emphasize public–private partnerships and trust-oriented legal reforms, whereas Oman and Kuwait prioritize infrastructure development and catch-up innovation. By contrast, Saudi Arabia and the UAE have invested heavily in frontier technologies, positioning themselves as regional leaders in AI and digital services.

This comparative analysis underscores that long-term success in ICT implementation requires a blend of anticipatory policy design, institutional agility, stakeholder engagement, and sustained investment. States that embed flexibility and feedback mechanisms in their digital policies are more likely to adapt effectively to global shifts and future technological disruptions.

4.2. Investment Architecture

Sustained governmental support and the establishment of a stable, investment-friendly legal environment are crucial to advancing the ICT sector and increasing its attractiveness to global and multinational firms. A well-structured legal and regulatory framework catalyzes FDI, which stimulates sectoral growth and positions the region as a competitive digital hub. Recent efforts to liberalize ICT services and open Arab markets to competition have yielded tangible benefits by encouraging the inflow of foreign capital and improving the reach and quality of telecommunications services. However, the full potential of this momentum can only be realized by completing and refining regulatory reforms, especially legislation to protect intellectual property rights, promote innovation, and ensure transparency and legal clarity for investors. In this context, modernizing investment laws in a manner that reflects the evolving demands of the ICT sector is imperative. This aspect includes eliminating structural and legal obstacles, streamlining bureaucratic procedures, and introducing targeted incentives such as tax exemptions, customs facilitation, and accessible financing mechanisms. Moreover, it is crucial to establish clear and enforceable mechanisms for dispute resolution to improve investor confidence. Collectively, these reforms contribute to the creation of a dynamic, resilient ICT investment ecosystem that not only supports domestic innovation but also facilitates in-depth integration with international technological networks and capital flows (Arab Monetary Fund, 2008).

The massive investments in 5G, data centers, and smart cities underpin the digital transformation among the GCC countries, with the UAE and Qatar leading in global ICT indices. However, regulatory harmonization and investor confidence remain uneven.

4.2.1. Investments in ICT Infrastructure

Advanced infrastructure, notably 5G networks, data centers, and Internet of Things (IoT) integration, drives sectoral efficiency and productivity. Studies have confirmed the positive link between Internet penetration and economic growth, particularly in supporting innovative applications (Chhabra et al., 2025). GCC countries have invested considerably in 5G networks, enabling services across various sectors, including healthcare, gaming, automotive technology, and the oil and gas sector. These services are central to smart cities, digital healthcare, e-government, and industrial automation. Moreover, ICT parks, such as Dubai Internet City, Qatar Science & Technology Park, Knowledge Oasis Muscat, and King Abdullah Science Park, exemplify national efforts to foster local innovation.

The UAE leads the region in this aspect, driven by national strategies and substantial investments in telecommunications. In 2023, the UAE was ranked as the fastest-growing 5G market globally, achieving 100% Internet penetration (Zawya, 2024). Meanwhile, Qatar demonstrated the highest 5G download speeds (312 Mbps) and a robust fiber infrastructure. Bahrain ranked among the top 20 globally for fiber penetration (Telecom Review, 2023). Saudi Arabia invested USD 24.7 billion over a six-year period, focusing on cloud computing, cybersecurity, and innovative city projects, such as NEOM, which integrates AI, biotechnology, and advanced communications (Hariwi, 2022).

Qatar's TASMU initiative, with investments of QAR 6.2 billion in 2023, prioritized IoT and GIS-based infrastructure. Likewise, Bahrain boasts an advanced digital infrastructure, ranking top among Arab nations by the ITU and fourth globally in the UN TII Index. Bahrain's TRA improved undersea cable infrastructure to ensure bandwidth reliability and international connectivity (Government of Bahrain, 2023).

The GCC data indicate that the majority of individuals in the region use the Internet, and most households have Internet access (Table 2). Further, the data indicate that nearly 100% of the GCC population is covered by a 3G or 4G mobile network (Table 3). The IDI ranks the GCC states highly in terms of the development of the ICT sector (Table 4).

Table 2. Universal Indicators of Connectivity, GCC, 2024.

	Individuals using the internet (%)	Households with Internet Access (%)	Active Mobile-Broadband Subscriptions Per 100 Inhabitants
Bahrain	100	100	157.6
Kuwait	99.7	99.4	151.5
Oman	97.8	97.1	115.9
Qatar	100	96.2	174
Saudi Arabia	100	100	126
UAE	100	100	234.9

Source: ITU.

Table 3. Meaningful Connectivity Indicators, GCC, 2024.

	Population covered by at least a 3G mobile network (%)	Population covered by at least a 4G/LTE mobile network (%)	Mobile-broadband internet traffic per subscription (GB)	Fixed-broadband internet traffic per subscription (GB)	Mobile data and voice high-consumption basket price (as % of GNI per capita)	Fixed-broadband internet basket price (as % of GNI per capita)	Individuals owning mobile phones (%)
Bahrain	100	100	316.9	3,092.5	1.7	3	100
Kuwait	100	100	664.5	10,003.1	0.7	1.2	99.2
Oman	100	99	73	4,157.2	2	3.7	97.8
Qatar	100	99.8	138.4	7,980.4	0.3	2	99.6
Saudi Arabia	100	100	420.7	6,888.8	1.3	4.5	100
UAE	100	99.8	100.1	6,614.6	1.1	0.7	100

Source: ITU.

Table 4. ICT Indicators, GCC, 2024.

	Universal connectivity pillar	Meaningful connectivity pillar	ICT development index (IDI)
Bahrain	100	95.1	97.5
Kuwait	100	99.9	100
Oman	92.4	91.0	91.7
Qatar	100	95.6	97.8
Saudi Arabia	94.7	96.8	95.7
UAE	100	94.9	97.5

Source: ITU.

4.2.2. Private-Sector Engagement

The private sector's involvement in ICT investments has had a higher multiplier effect on non-oil GDP compared with its non-ICT investments. This finding indicates that private investments in ICT can significantly contribute to efforts toward economic diversification within the GCC (Alshubiri et al., 2019). Harmonization between public and private investments is recommended to maximize the impact of private-sector engagement in ICT growth through a synergistic effect. In addition, adequate investment in financial systems is essential to support and sustain ICT advancements driven by private enterprises (Alhajri, Almahruqi, Buraiki, & Abida, 2024).

In the Middle East, especially within the GCC, the ICT sector is characterized by a dynamic combination of multinational giants, regional players, and emerging startups that collectively contribute to the region's digital transformation. Among the major global companies leading this transformation, Microsoft stands out with a broad portfolio of software, hardware, and cloud-computing solutions that enhance the efficiency, scalability, and security of businesses and governments. Meanwhile, Oracle, a pioneer in database management systems, specializes in providing enterprise software solutions catering to its customers' complex business needs. Intel, a leader in semiconductor manufacturing, continues to power the devices and infrastructure that underpin modern technological advancements. IBM is another key player, offering IT consulting services and a variety of software and hardware

solutions supporting various industries, from banking to manufacturing, in adopting digital technologies and optimizing their operations (Mordor, 2025; World of Technology, 2023).

Regionally, companies such as Zain, STC, Ooredoo, and Mobily play crucial roles in shaping the ICT landscape. With a substantial presence in countries such as Kuwait and Saudi Arabia, Zain is recognized as a leading telecommunications provider, offering a comprehensive range of mobile, Internet, and digital services (Abed Alrahman, 2025; World of Technology, 2023). Meanwhile, STC, a major player in Saudi Arabia, provides a wide range of services, including mobile communications, broadband Internet, and cloud computing, and has become a key driver of digital transformation in the country. Operating in Qatar and several other Middle Eastern countries, Ooredoo focuses on providing advanced mobile and broadband Internet services (Cornish, 2024), and Mobily is another major telecom operator in Saudi Arabia that has continued to expand its footprint by providing innovative communication solutions.

In addition to these companies, a growing number of small and medium-sized enterprises (SMEs) are emerging in the region that focus on developing cutting-edge solutions in areas such as AI, IoT, and cloud services. Companies such as Sabr and Saudi Data play important roles in providing cloud computing and digital solutions that are tailored to the needs of SMEs, which are essential to the region's economy.

Furthermore, companies such as GE Digital and SAP are contributing significantly to the ICT sector by developing specialized solutions for Industrial IoT and enterprise resource planning systems. GE Digital's Industrial IoT solutions are designed to optimize industrial processes, improving efficiency and reducing operational costs. Conversely, SAP's cloud-based software solutions enable companies to manage and streamline their processes, accelerating digital transformation.

This diverse mix of global, regional, and emerging players underscores the dynamic nature of the ICT sector in the Middle East, where collaboration across various levels from multinationals to startups drives innovation, enhances digital infrastructure, and promotes economic diversification. The continued growth of this sector is critical to the region's transition to a knowledge-based economy, where technology serves as the backbone of future development.

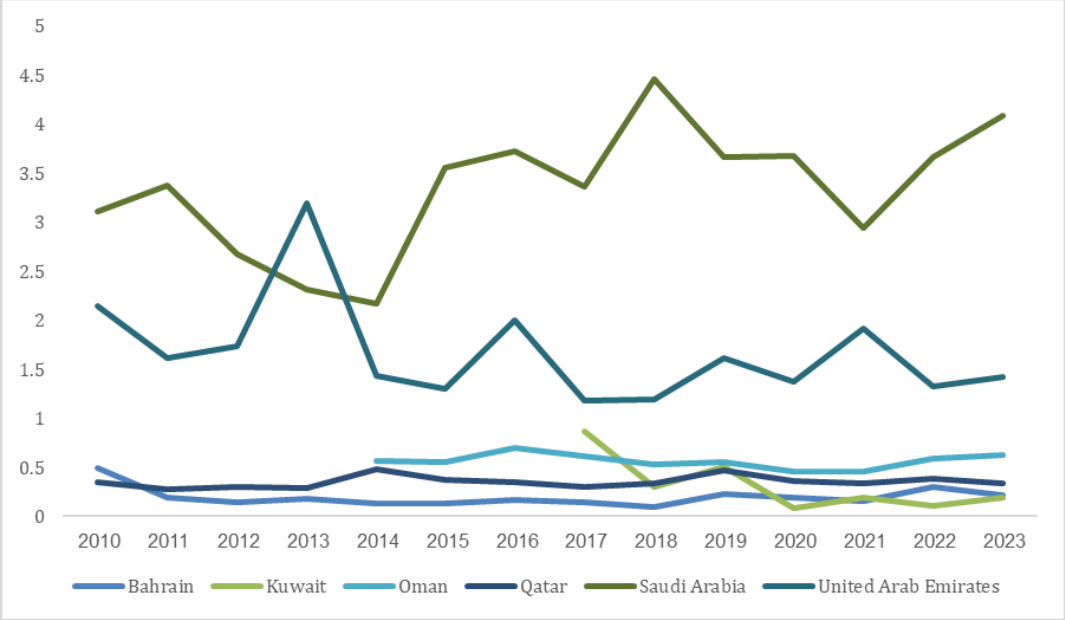

Figure 1. Annual investment in telecommunication services, GCC, 2010–2023, B$.

Source: ITU.

Figure 1 illustrates investments in telecommunications services in the GCC countries, indicating Saudi Arabia and the UAE as leading countries. Ooredoo Qatar and Vodafone Qatar have made substantial annual investments

exceeding QAR 1 billion since 2017. These investments have extended beyond telecommunications infrastructure to include data centers, cloud infrastructure, and the development of essential services to support the sector's expansion. The majority of ICT companies in Qatar prioritize delivering customer services over innovating or expanding their service offerings (Communications Regulatory Authority (CRA) of Qatar, 2023).

4.2.3. FDI and International Partnerships

FDI, especially through multinational partnerships, has played a critical role in advancing the ICT sector. In particular, the UAE and Saudi Arabia have attracted global tech companies by providing favorable regulatory environments and have thus established themselves as regional hubs for technology companies. However, barriers remain, including an overreliance on foreign expertise, which has limited the growth of local R&D capabilities in certain contexts.

The UAE, primarily Dubai, has emerged as the premier ICT market in the region. The proactive development of its technology sector has attracted industry giants such as Cisco, Intel, Oracle, and SAP, making the UAE a leader in information technology. This growth is poised to drive the digitization of the economy, fostering innovation and efficiency. Significant developments such as IoT and Expo 2020 have contributed to further expanding the ICT market. The ICT sector in the UAE encompasses a robust range of offerings, including computer hardware sales, software solutions, and comprehensive information technology services.

Several international companies have invested in the UAE's ICT market. In 2016, Alibaba launched Alibaba Cloud and established a new data center in Dubai. Meanwhile, in 2018, AWS opened its first office in Dubai. These investments have increased the supply of ICT services, enabling the sector to meet increasing local and regional demands. Companies should continue to invest in the information technology infrastructure, particularly in network systems, computer hardware, and software, which should result in increased demand for such services. The ICT market in the UAE offers numerous commercial opportunities for companies that supply information technology products and increases investments from the private and public sectors.

Furthermore, national regulatory environments and government-driven investment facilitation measures have significantly influenced FDI in the ICT sector across the GCC. In recent years, GCC governments have actively promoted foreign investment through streamlined legal frameworks, dedicated investment promotion agencies, and pro-investment legislation. According to data from the ITU for 2022 (Table 5), the regulatory approach to foreign participation in the ICT sector considerably varies across the GCC. Countries such as Kuwait, Oman, and the UAE exhibit relatively open regimes, with few formal restrictions on foreign ownership. In contrast, Saudi Arabia and Qatar maintain certain restrictions, although they permit foreign ownership under specific conditions. For example, Saudi Arabia allows foreign ownership to be controlled (51%–99%) in several ICT sub-sectors, including international and Internet service providers and spectrum-based operators. Generally, however, the treatment of foreign providers is the same as that of domestic entities under Saudi regulations. Meanwhile, Qatar permits only minority foreign ownership (1%–49%) in ICT sub-sectors, reflecting a cautious stance.

The UAE has set a standard for regulatory practices by implementing the Foreign Direct Investment Law, permitting 100% foreign ownership in designated sectors, including the ICT sector. This progressive framework, combined with a sophisticated digital infrastructure and proactive government support, has effectively positioned the UAE as a regional hub for global technology firms and investors. In contrast, although all GCC countries have established legal provisions for foreign participation, none currently offer specific regulatory advantages or concessions to foreign ICT providers, such as preferential licensing terms.

Restrictions on foreign ownership serve as a critical determinant of investment inflows. Countries that maintain fewer barriers and have well-defined legal frameworks such as the UAE and Oman are generally in a stronger position to attract multinational ICT companies. Conversely, restrictive environments impede the ability to attract foreign capital. In conclusion, the current trends in the GCC indicate a gradual, albeit uneven, movement toward

liberalization. This shift reflects an increasing recognition among governments of the strategic role played by foreign investment in fostering growth within the ICT sector and supporting broader digital transformation objectives.

Table 5. Foreign Participation, GCC, 2022.

	Saudi Arabia	Kuwait	Oman	Qatar	United Arab Emirates (UAE)
Restricts foreign participation or ownership in the ICT sector.	Yes	No	No	Yes	No
Allows foreign ownership in facility-based operators.	No, foreign providers are treated in the same manner as domestic providers.				
Allows foreign ownership in facility-based operators.	Controlling interest (51%–99%)			Minority interest (1%–49%)	
Allows foreign ownership in international service operators.	Controlling interest (51%–99%)			Minority interest (1%–49%)	
Allows foreign ownership in Internet service providers.	Controlling interest (51%–99%)			Minority interest (1%–49%)	
Allows foreign ownership in local service operators.	Controlling interest (51%–99%)			Minority interest (1%–49%)	
Allows foreign ownership in long-distance service operators.	Controlling interest (51%–99%)			Minority interest (1%–49%)	
Allows foreign ownership in spectrum-based operators.	Controlling interest (51%–99%)			Minority interest (1%–49%)	
Allows foreign ownership in value-added service providers	Controlling interest (51%–99%)			Minority interest (1%–49%)	
Legal act that addresses foreign participation and ownership in ICTs	Yes	Yes	Yes	Yes	Yes
Provisions for foreign suppliers/licensees	No	No	No	No	No
Regulatory treatment of foreign providers	No, foreign providers are treated in the same manner as domestic providers.				
Restricts foreign participation or ownership in the ICT sector.	Yes	No	No	Yes	No
Specific regulations					UAE FDI Law

Source: ITU. Data for Bahrain are missing.

Not all GCC countries publish disaggregated data on foreign investment in the ICT sector, making it difficult to comprehensively assess the evolution of foreign investment across the region and during the research period. Among the GCC states, Saudi Arabia is the only country to provide publicly accessible data on FDI inflows and stocks specifically within the ICT sector. According to the data in Figure 2, a notable increase has occurred in FDI stock in Saudi Arabia's ICT sector from 2017 to 2023. During this period, foreign investment stocks increased from USD 3.73 billion to USD 8.46 billion, representing a rise of approximately 127%. This upward trend highlights Saudi Arabia's growing appeal to foreign investors in the digital economy, driven by sectoral reforms, liberalization efforts, and strategic initiatives aligned with Vision 2030 (2016). Meanwhile, for Bahrain, a decline was observed in FDI stock in the ICT sector between 2019 and 2022, followed by an increase in 2023 (Figure 3).

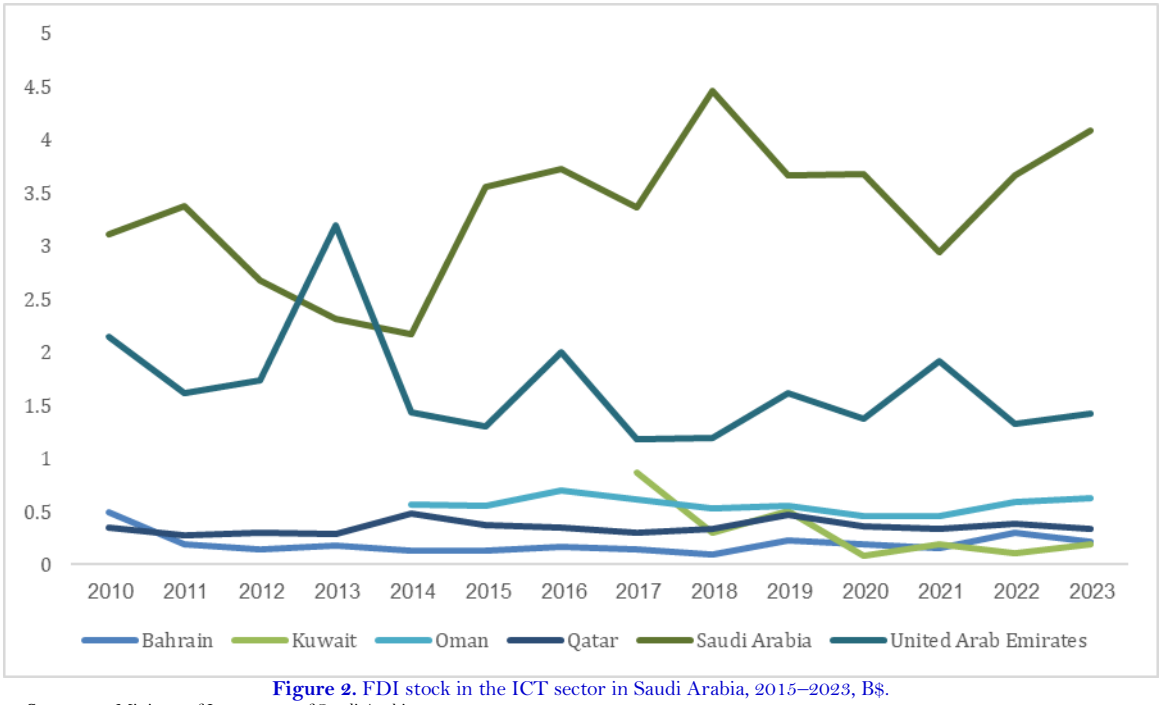

Figure 2. FDI stock in the ICT sector in Saudi Arabia, 2015–2023, B$.
Source: Ministry of Investment of Saudi Arabia.

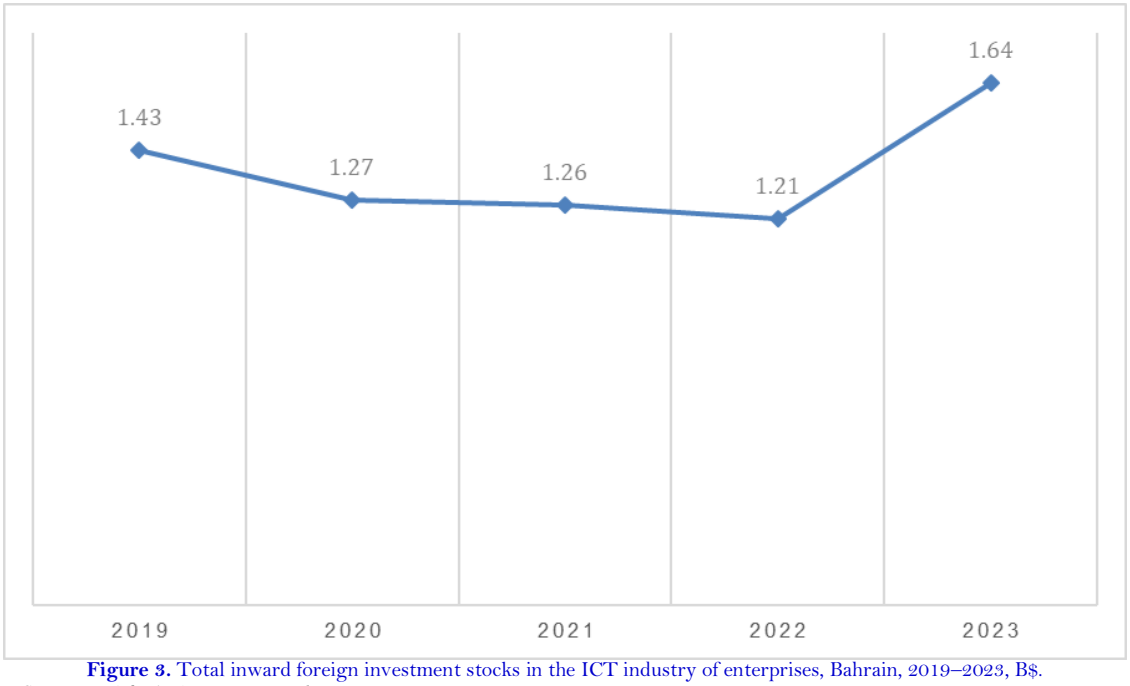

Figure 3. Total inward foreign investment stocks in the ICT industry of enterprises, Bahrain, 2019–2023, B$.
Source: Bahrain Open Data Portal.

For the UAE, Oman, and Qatar, only limited data regarding foreign investment in the ICT sector are available.

In conclusion, the GCC's investment landscape reveals apparent asymmetries. Saudi Arabia and the UAE lead in mobilizing diversified capital for large-scale ICT initiatives, underpinned by sovereign wealth funds, public–private partnerships, and strategic foreign collaborations. Meanwhile, Qatar and Bahrain distinguish themselves through targeted innovation investments and robust legal frameworks that enhance investor confidence. Oman and Kuwait, while making significant strides, continue to face structural and institutional barriers that limit the scale and impact of their investments.

A key determinant of the sector's success lies in the interplay between investment instruments and governance capacity. Countries that match financial commitments with agile regulatory mechanisms and international integration

such as the UAE and Bahrain have succeeded in fostering dynamic digital ecosystems. In contrast, delayed implementation, limited private-sector incentives, and regulatory opacity have constrained progress in Oman and Kuwait.

4.3. Education and Human Capital

Human capital is pivotal to the sustainable growth of the ICT sector in the GCC. However, despite considerable investments in education and training, critical skill gaps persist in areas such as AI, cybersecurity, software engineering, user experience (UX) design, and data analytics (McKinsey & Company, 2020; Sengupta & Garg, 2024). While collaborations with global technology firms such as Cisco, Google, and Microsoft have expanded (Hariwi, 2022), labor markets remain heavily segmented and reliant on expatriate expertise. This structural dependence hinders the development of self-sustaining innovation ecosystems (Sengupta & Garg, 2024).

To address this concern, the governments have introduced curricular reforms and targeted training programs to strengthen locals' digital proficiency. These efforts aim to align higher education with the needs of the labor market, focusing on competencies such as ICT application, project management, customer service, digital marketing, and sales (Faououl & Talha, 2020). Initiatives such as Saudi Arabia's Digital Capabilities Development Program and the UAE's DisruptED platform reflect strategic national efforts to bridge skill mismatches (Telecom Review, 2023; The International Institute for Strategic Studies (IISS), 2024). However, the lack of comprehensive, standardized data on ICT graduates across the GCC prevents a rigorous assessment of their workforce readiness (Karzhanova & Avvakumova, 2025).

The results of recent surveys highlight the severity of the challenge, underscoring the need for tailored, sector-specific training. The 2025 PwC CEO Survey reports that 34% of regional business leaders view talent shortages as a top strategic concern (PwC Middle East, 2025). Bahrain's Tamkeen identified ongoing deficits in qualified local telecommunications personnel (Tamkeen, 2022). In this context, vocational education centers, such as Bahrain's Nasser Vocational Training Center through its Smart Coders initiative, which aims to train 10,000 programmers by 2027, represent a scalable response (Telecom Review, 2023).

GCC universities are increasingly emphasizing digital transformation in teaching and research. Leading institutions in Saudi Arabia, Qatar, and the UAE have attained top rankings in the Arab region and are investing heavily in AI, data science, and innovation labs (Karzhanova & Avvakumova, 2025).

Nonetheless, bureaucratic inertia, limited and inadequate collaborations between academia and industries, and weak performance evaluation mechanisms continue to constrain outcomes. Overcoming these barriers calls for an integrated, innovation-driven approach to educational planning that aligns with national digital agendas (McKinsey & Company, 2020).

Furthermore, strategic partnerships with global technology firms remain essential. Notably, examples include the collaborations between Group 42 and Microsoft/OpenAI in the UAE and workforce upskilling initiatives with Google in Saudi Arabia (Hariwi, 2022; The International Institute for Strategic Studies (IISS), 2024). The Cisco Networking Academy has trained nearly 300,000 young Saudis in cybersecurity and related fields (Hariwi, 2022). While impactful, these initiatives require broader scalability and closer integration with national employment strategies to fully support an innovation-driven economy.

In summary, despite meaningful progress in developing digital skills in the Gulf region, substantial gaps persist. A lack of comprehensive data on educational outcomes, continued reliance on expatriate labor, and underdeveloped domestic research ecosystems emphasize the need for deeper institutional reforms and sustained investments. Advancing human capital in the GCC's ICT sector requires a strategic alignment of education policies, labor market incentives, and public–private collaborations to ensure long-term digital resilience and competitiveness.

4.4. Local Innovation Ecosystems and Entrepreneurship

In recent years, the development of local innovation ecosystems and entrepreneurship in the GCC has accelerated, driven by national economic diversification and digital transformation strategies. Innovation ecosystems operate as interdependent networks where researchers, entrepreneurs, and policymakers can collaborate to drive technological advancement and commercial experimentation (Tadros, 2015). Entrepreneurship, as noted by Miniaoui and Schilirò (2016), serves as a critical engine for economic and social progress, fostering job creation, enhanced competition, and improvements in living standards. Furthermore, entrepreneurial ventures are key drivers of technological innovation and social change (Al-Housani, Al-Sada, & Koç, 2024).

The GCC members have increasingly prioritized building startup-friendly market environments. By 2025, the region has witnessed the formation of over 60,000 startups, with more than 4,240 ventures receiving a combined investment exceeding USD 266 billion (Tracxn, 2025). Notably, Saudi Arabia's entrepreneurial landscape has expanded significantly, with SME registrations rising by 48% between 2016 and 2021, and the total surpassing 650,000 registered firms. Saudi Arabia aims to increase the startup sector's contribution to the GDP from 21% in 2016 to approximately 35% by 2030, aligned with Vision 2030 (Bhat, 2024). Multiple flagship initiatives have been implemented to support this growth. Misk Innovation has supported 193 startups through 10 accelerator cohorts, generating over 3,430 jobs and achieving a cumulative valuation of USD 2.28 billion (Misk Accelerator, 2025). Saudi Arabia has also launched Human Ventures, a USD 10 billion venture capital fund focused on AI startups across the world (England & Al Omran, 2025). Meanwhile, the Tech Growth Financing Initiative, under the National Technology Development Program, provides loan guarantees covering up to 90% for tech-based SMEs (Hariwi, 2022).

Meanwhile, the UAE has consolidated its position as a regional innovation hub. In Q2 of 2024, 5,600 new startups were registered, supported by platforms such as Dubai Internet City, Sandbox Dubai, and the Mohammed Bin Rashid Innovation Fund (2024). Strategic collaborations, including those between Group 42 and Microsoft/OpenAI, have further strengthened Abu Dhabi's global innovation profile (The International Institute for Strategic Studies (IISS), 2024).

Bahrain's ecosystem is supported by the Al Waha Fund of Funds and regional accelerators such as Flat6Labs and Brinc, which focus on fintech and IoT ventures. Meanwhile, Oman's innovation ecosystem is shaped by the Oman Technology Fund and the Space of Innovation program, which have supported over 80 startups to date. Kuwait's initiatives, such as Kuwait Tech and its National SME Fund, demonstrate growing institutional support for digital entrepreneurship. Similarly, Qatar's Science and Technology Park serves as a key hub for ICT innovation, providing infrastructure, tax incentives, and R&D support.

Despite this progress, key barriers persist. Capital constraints, insufficient protection of intellectual property (IP) rights, regulatory complexities, and limited context-specific mentorship hinder ecosystem growth. For instance, while Qatar has adopted reforms inspired by successful ecosystems like those of Norway, challenges remain in ensuring regulatory transparency, financial access, and mentorship quality (Al-Housani et al., 2024).

SMEs are critical to advancing the ICT sector; however, their potential remains substantially underutilized. The Arab Monetary Fund (2008) highlights the need for targeted financial incentives, streamlined regulatory frameworks, and improved credit access. In addition, strengthening technology incubators, expanding venture capital initiatives, and establishing robust performance monitoring systems are essential for supporting startup scalability and sustainability.

The 2024 Global Innovation Index, developed by Cornell University, INSEAD, and the World Intellectual Property Organization (WIPO), reveals significant disparities in innovation capacity among GCC members: UAE (32nd), Saudi Arabia (47th), Qatar (49th), Kuwait (71st), Bahrain (72nd), and Oman (74th). Although policy frameworks have resulted in improvements to these rankings, the countries' innovation ecosystems continue to rely heavily on state-led funding and regulatory intervention (World Intellectual Property Organization (WIPO), 2024).

In conclusion, the GCC has made substantial progress in fostering digital entrepreneurship. However, transitioning from state-driven models to self-sustaining innovation ecosystems requires further institutional reform. Priorities should include enhancing IP protection, expanding venture capital access, strengthening university–industry linkages, and nurturing a risk-taking culture.

4.5. Strategic Technology Dependencies in the GCC amid U.S.–China Rivalry

GCC countries have been increasingly reliant on imported digital technologies to advance their national transformation agenda. These technologies include cloud-computing platforms, AI systems, telecommunications infrastructure, and smart city solutions. While the imports have accelerated digital modernization, they have exposed the region to intensifying geopolitical competition, particularly between the United States and China (Chaziza, 2025).

Figure 4 highlights a stark imbalance in imports, with the UAE and Saudi Arabia accounting for the vast majority of goods inflows in the GCC. UAE imports surged from USD 28 billion in 2012 to USD 60 billion in 2023, reflecting its role as a regional re-export hub. Saudi Arabia follows at USD 24 billion, driven by 5G rollouts and NEOM procurement. However, even when combined, Qatar, Bahrain, Oman, and Kuwait contribute less than 10% of total imports in the GCC, showing only modest growth. These figures reflect high supply-chain concentration and near-total dependence on foreign hardware in the region, underscoring the need for technology transfer agreements, local assembly mandates in large markets, and pooled procurement mechanisms for smaller economies.

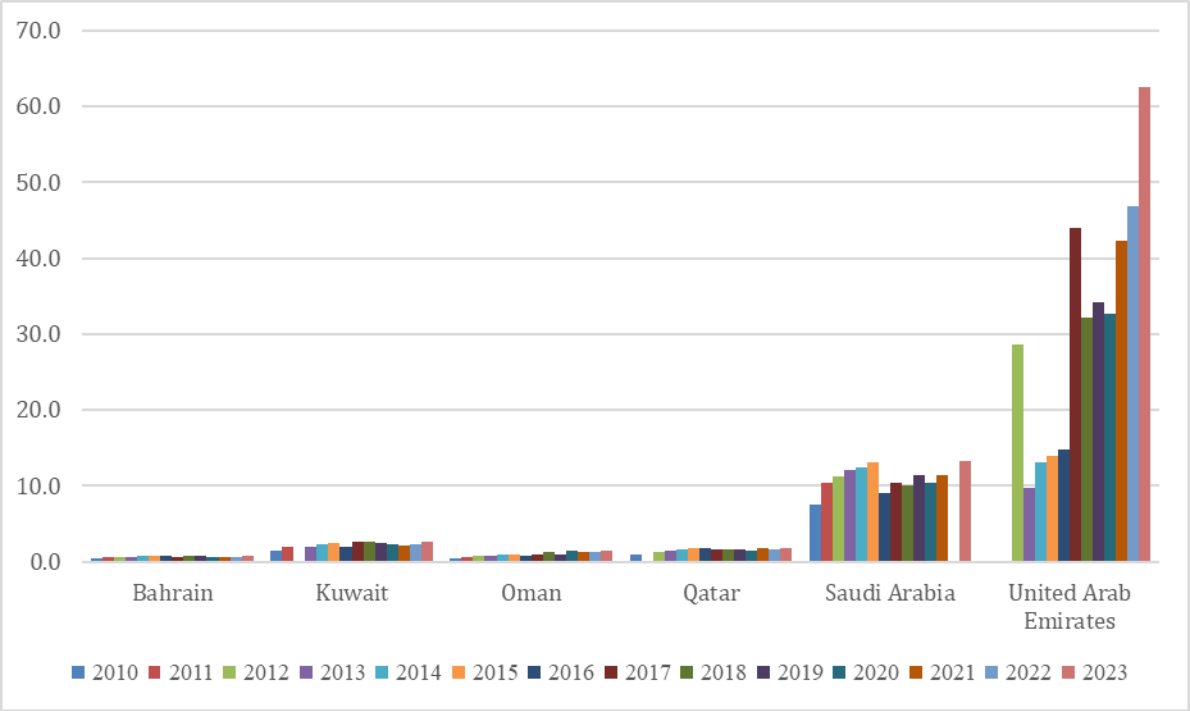

Figure 4. ICT goods imports, GCC, 2010–2023, B$.

Source: UNTCAD.

China has emerged as a key provider of affordable, integrated digital infrastructure. Firms such as Huawei, Alibaba Cloud, and SenseTime offer bundled services, including 5G networks, AI applications, and cloud services, at competitive prices. Huawei's dominance in 5G deployment is particularly evident in the UAE and Saudi Arabia, where local operators prioritize rapid infrastructure expansion (Calabrese, 2019). These offerings are attractive to governments seeking accelerated digital progress within fiscal constraints. Conversely, U.S.-based firms such as AWS, Microsoft Azure, and Oracle Cloud still maintain a strong foothold in cloud computing and cybersecurity, benefiting from long-standing alliances and regulator trust. AWS operates data centers in Bahrain, and Microsoft

and Oracle have expanded their infrastructure in the UAE and Saudi Arabia. These investments are often reinforced by Western political guarantees on cybersecurity and data protection (Hassib & Shires, 2022).

This dual alignment creates leverage as well as dependency. On the one hand, the GCC members can negotiate favorable terms by balancing their relationships with both sides. On the other hand, they face growing Western pressure to limit partnerships with Chinese firms, especially in sectors linked to national security and data sovereignty. For example, the U.S. Department of Commerce issued advisories in 2022 regarding the risks of using Huawei components in critical infrastructure advisories that influenced procurement decisions in Bahrain and Kuwait (Gallagher, 2022).

Beyond the U.S.-China dynamic, other countries, including India, Japan, South Korea, and Israel, have emerged as key providers of specialized technology solutions in fields such as fintech, robotics, digital healthcare, and smart manufacturing. For instance, Israel's Mobileye has piloted autonomous vehicle projects in the UAE, and South Korean firms have engaged in AI collaborations with Qatari universities (The International Institute for Strategic Studies (IISS), 2024).

Policymakers across the GCC are increasingly recognizing that technology imports are not only economic choices but also strategic decisions with long-term implications. Several countries have begun diversifying their technology partnerships and investing in domestic capabilities. Notably, the UAE has initiated localization programs for data storage and AI development, and Saudi Arabia's NEOM project includes mandates for in-house research in AI and robotics. In this context, a balanced procurement strategy that prioritizes national interests with digital resilience is essential. This involves diversifying supplier networks, establishing data governance frameworks, promoting local innovation ecosystems, and strengthening regional collaboration to share best practices and reduce collective exposure to external disruptions.

Ultimately, the GCC's digital future depends on gradually shifting from its dependency on imported technologies toward building its technological independence. This strategic change necessitates ongoing investments in education, intellectual property, and public–private partnerships.

5. DISCUSSION

This study's analysis reveals that technological progress in the GCC is primarily driven by top-down decisions from government leadership rather than bottom-up initiatives from grassroots initiatives. These efforts are embedded within larger national agendas aimed at economic diversification and reinforcing political legitimacy. This approach aligns with the rentier state theory, which proposes that governments with abundant resources use their wealth to drive modernization initiatives. In other words, resource-rich governments leverage their wealth to pursue modernization without significant reliance on grassroots innovations or democratic engagement (Hertog, 2010).

Public institutions, supported by international partners, play a central role in shaping the ICT landscape within the GCC. By leveraging substantial financial resources, the GCC members have rapidly deployed advanced infrastructure, launched smart city initiatives, and invested in digital platforms, thus accelerating their modernization efforts. While this state-centric model delivers swift, large-scale outcomes, it often constrains the development of dynamic, grassroots-based innovation ecosystems. As outlined by Cihon, Maas, and Kemp (2020), centralized governance structures can inhibit experimentation, decelerate institutional learning, and foster a dependence on foreign knowledge systems.

International collaborations have been critical for transferring advanced digital technologies and capital into the region. However, this dependence prompts concerns regarding technological sovereignty and long-term resilience. Without parallel investments in domestic R&D, educational reform, and robust IP frameworks, GCC countries risk entrenching a model of passive technology adoption. Although initiatives aimed at addressing these concerns are in progress, such as coding programs in Saudi schools and the establishment of AI research centers in the UAE, the institutionalization of these efforts remains inconsistent (Audina, Kartiasih, & Yuliana, 2024). The escalating U.S.–

China technological rivalry further complicates strategic decision-making for GCC policymakers. While Gulf states have leveraged this competition to secure favorable investment terms, this approach has heightened geopolitical risks, particularly in sectors concerning cybersecurity and data governance (Bin Huwaidin, 2024).

Despite an increasing emphasis on human capital development, structural constraints persist. In particular, the mismatch between higher education outcomes and labor market demands represents a key constraint. Despite reforms and new university programs, many graduates lack the practical skills necessary for gaining employment in a rapidly evolving tech sector (Sengupta & Garg, 2024). The persistent segmentation of labor markets, where expatriates often occupy high-skilled digital roles, further weakens the integration of local talent. Nevertheless, positive shifts are emerging. In particular, female participation in the digital economy is rising, especially in Saudi Arabia and the UAE, signaling the potential for broader inclusion if institutional and cultural barriers are addressed (PwC Middle East, 2025).

While state-driven innovation remains dominant in the GCC, grassroots entrepreneurship especially youth entrepreneurship, fintech, and creative tech ventures is gaining momentum in hubs such as Dubai, Riyadh, and Doha. Initiatives such as Misk Innovation, the Mohammed bin Rashid Innovation Fund, and Qatar's Science & Technology Park indicate growing policy efforts to foster private-sector innovation. However, these efforts tend to remain reliant on government financing or policy frameworks, limiting their long-term autonomy (Al-Housani et al., 2024).

As shown in Figure 5, the growth trajectory of the ICT sector is uneven across the GCC. Saudi Arabia leads, with its sectoral value-added growth rising from approximately 16% in 2010 to 28% in 2023, driven by extensive public spending on the 5G rollout, the NEOM megaproject, and a series of venture capital incentives. The UAE follows suit, nearly doubling its contribution from just under 8% to around 14%, underpinned by an open investment regime and aggressive cloud-computing incentives that have drawn global players such as AWS and Oracle. Qatar and Bahrain exhibit more moderate and steady gains, constrained by smaller domestic markets and a greater reliance on foreign operators for data center capacity. Finally, Oman and Kuwait remain at the lower end, with growth rates hovering below the 5% band, reflecting slower infrastructure deployment and limited private capital inflows.

This divergence highlights the need for differentiated policy strategies. Front-runner economies should focus on deepening local R&D capacity, scaling indigenous content, and fostering technological sovereignty. Meanwhile, smaller markets would benefit from an emphasis on stronger regional cooperation, shared digital infrastructure, and targeted venture capital schemes to bridge persistent financing and capacity gaps.

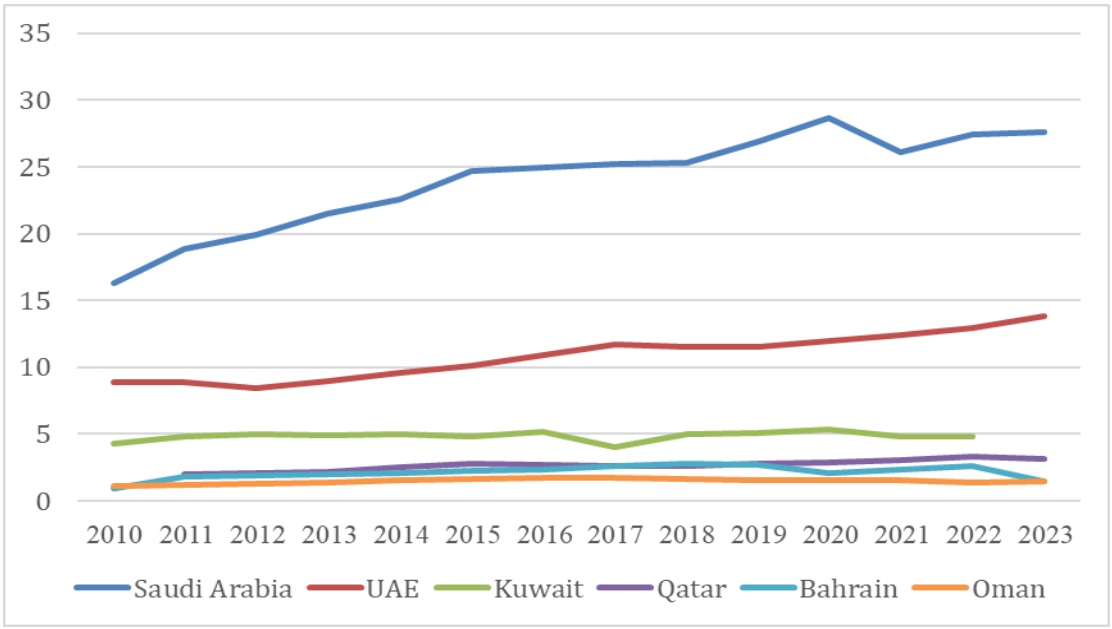

Figure 5. ICT added value in GCC, 2010–2023, current prices, B$.

Source: GCC-STAT.

To secure a resilient and sustainable digital future, GCC members must adopt hybrid governance models that support adaptive policymaking, foster institutional pluralism, and encourage local innovation. Future success will depend on decentralizing innovation processes, embedding feedback mechanisms, investing in domestic intellectual capital, and balancing global technology partnerships with indigenous capacity-building.

This study's analysis contributes to the broader discussion on how rentier economies can transition toward knowledge-based development by identifying political and institutional enablers and constraints unique to the region. It highlights the need for nuanced strategies that combine state-led direction with societal participation and underscores the importance of strategic autonomy amid growing global technological fragmentation.

To transform the current patchwork of national digital initiatives in the region into a cohesive regional framework, this study proposes a dual-track strategy. At the regional level, it recommends establishing a "GCC Digital Investment Gateway" to harmonize licensing, spectrum allocation, taxation, and data-localization rules. This would result in a high-risk co-investment fund that would be equivalent to 0.5% of the bloc's GDP for frontier technologies. The gateway should mandate knowledge-transfer clauses in major foreign contracts; launch an independent Digital Economy Observatory with quarterly dashboards tracking five core key performance indicators; implement an incentive matrix linked to gender, nationality, and decarbonization targets; and launch a "Universities for the Digital Economy" alliance to standardize STEM curricula and apprenticeships. The framework should then be tailored by country to bridge the different starting points. Saudi Arabia must spread venture capital beyond Riyadh and integrate its regulatory sandboxes. Meanwhile, the UAE should channel 6 GHz auction revenues toward peripheral-fiber rollout and reward firms that meet a 25% Emirati data science quota. Qatar needs to implement a scale-up fund and local equity rules for new data centers. Bahrain should internationalize its Al Waha fund and impose annual cyber audits; Oman must accelerate its Sat-Connect satellite project and cut licensing times via a one-stop digital window. Finally, Kuwait should enact a data protection law and entice investments from private data centers with five-year customs holidays.

Taken together, these measures would knit disparate efforts into an integrated digital economy system for the GCC that can attract higher-quality FDI, nurture local talent, and deliver broad, sustainable growth.

6. CONCLUSION

This comparative, policy-oriented study aimed to identify the principal drivers and barriers shaping ICT development across the Gulf region. Drawing on 68 core policy documents and 5 multilateral briefs, the analysis confirms that ICT modernization in the Gulf region remains predominantly state-led, framed by long-term national visions and reinforced by sizable public-sector spending. These top-down strategies have accelerated 5G rollouts, cloud data center investments, and state-of-the-art e-government services, propelling the UAE, Qatar, and Bahrain into the top decile of the ITU IDI (International Telecommunication Union (ITU), 2024). However, the study also reveals persistent bottlenecks: uneven knowledge spillovers from FDI, an underrepresentation of domestic talent in high-value digital roles, regulatory fragmentation that discourages venture capital in smaller markets, and a growing dependency on imported technologies amid the U.S.–China rivalry.

The findings validate two core propositions. First, state-led models can achieve rapid infrastructure gains but risk stifling bottom-up innovation if localization policies, regulatory sandboxes, and IP protections remain lacking. Second, diversified investment frameworks and coherent regional governance models, such as a Digital Investment Gateway, a GCC Digital Economy Observatory, and harmonized data protection laws, can help support sustainable and inclusive digital ecosystems. Tailored national strategies can then convert these regional priorities into actionable steps.

The study's generalizability is limited by two factors: its reliance on publicly available documents, which may overstate policy implementation relative to outcomes, and the absence of econometric impact analysis in favor of qualitative pattern-matching. Future research should triangulate policy narratives with firm-level productivity data,

conduct longitudinal analyses of startup trajectories, and explore how emerging technologies, such as generative AI, quantum communications, and green hydrogen, reshape digital strategies in the Gulf. Despite these limitations, the study's findings demonstrate that a regionally coordinated, innovation-driven approach anchored in transparent governance, targeted human capital investment, and cross-border knowledge networks offers the most resilient pathway for the GCC to convert its digital infrastructure into long-term socioeconomic value.

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Data Availability Statement: Upon a reasonable request, the supporting data of this study can be provided by Mona Massalha.
Competing Interests: The author declares that there are no conflicts of interests regarding the publication of this paper.

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