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Article

Innovation-Based Strategic Roadmap for Economic Sustainability and Diversity in Hydrocarbon-Driven Economies: The Qatar Perspective

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Abstract: This research addresses the critical opportunities and challenges confronting economic sustainability for hydrocarbon-based economies. The primary objective is to advocate for a transformative shift towards diversified and knowledge-centric economic models to ensure long-term sustainability. The literature review exposes vulnerabilities in hydrocarbon-based economies. The study innovatively explores multifaceted dimensions of economic diversification, including governance issues, societal well-being, and the necessity for robust ecosystem frameworks. Utilizing a qualitative case study methodology, the research investigates Qatar's initiatives, such as the Qatar National Vision 2030 and government programs, aiming to reduce dependence on hydrocarbons and foster innovation. Insightful semi-structured interviews provide nuanced perspectives on innovation in the hydrocarbon context with business and academic professionals. The primary data collection method involves distinct groups: 5 business professionals and 11 academic experts, representing 8 outstanding local and external organizations. Key findings underscore a holistic view of innovation, associating it with practical solutions, adaptability, and transformative potential, showcasing diverse approaches ranging from business-centric to collaborative and user-centric methods. Identified challenges in the education system, the urgency for a matured innovation ecosystem, and opportunities in sustainable energy further enrich the study. The research recommends sustained efforts in economic diversification, educational reform, and technological integration for hydrocarbon-based economies. Policymakers, businesses, and academics can leverage these insights to navigate the complexities of resource dependency and ensure long-term viability. The commitment to addressing challenges faced by hydrocarbon-dependent nations remains crucial, with a dedication to fostering economic diversity, innovation, and educational excellence for a resilient and prosperous future.

Keywords: innovation ecosystems; economic sustainability; hydrocarbon-based economies; economic diversification; qualitative approach

1. Introduction

In the context of hydrocarbon-based economies, maintaining economic sustainability is crucial for ensuring the continued success of a country's economy. A significant portion of revenue in these economies is derived from the sale of hydrocarbons (Flamos, Roupas, & Psarras, 2013). According to Mishrif (2018) definition, economic diversification implies the development of policies that reduce dependence on a single industry or sector, such as oil, in terms of its contribution to Gross Domestic Product (GDP), export earnings, and government revenues. This diversification involves increasing reliance on non-hydrocarbon sectors like services, manufacturing, tourism, and agriculture, creating new sources of government income.

Economic diversification plays a vital role in fostering business development, generating job opportunities for a growing population, and, importantly, mitigating the risks associated with oil price dependence and high economic concentration (Schilirò, 2013). The backbone of hydrocarbon-based economies revolves around commodity prices, known for their volatile nature, creating unique economic circumstances (Smith, 2019). These economies are particularly susceptible to fluctuations

in oil prices, making long-term predictions challenging (Cevik, 2014). The unpredictable nature of oil prices poses a primary concern for these economies, which have experienced various booms and busts over the last five decades (Smith, 2019).

The fluctuations in oil prices have left some major hydrocarbon-producing nations economically disadvantaged during periods of price drops (Ustaoğlu & İncekara, 2017). These crises underscore the need for diversifying revenue sources in hydrocarbon-based economies to ensure financial stability amid external factors (Darina & Daurtsev, 2018).

A significant challenge lies in the substantial decline in hydrocarbon prices over the past five decades. Countries dependent on hydrocarbon exports have adversely impacted budgetary conditions, income stress, urban development, and trade balance (Göçer, 2016). According to Mishrif (2018), the last decade witnessed a significant drop in hydrocarbon prices, plummeting by 70% in 2016 to around US\$ 30 after reaching US\$ 100 between 2010 and 2014. This volatility raised serious concerns about the sustainability of hydrocarbon economies, prompting calls for the development of diversified economies capable of withstanding such fluctuations (Ustaoğlu & İncekara, 2017).

Recent events have emphasized the importance of economic diversification in light of dramatic drops in hydrocarbon prices (Ustaoğlu & İncekara, 2017). Mishrif (2018) highlights the fragility of national economic cycles, citing the negative impacts of oil price fluctuations on export revenues, government income, and overall GDP growth. Evidence supports the idea that economic sustainability is crucial for a nation's success, necessitating a comprehensive, long-term approach to hydrocarbon revenue utilization (Aitzhanova et al., 2015).

Hydrocarbon-based economies are highly vulnerable to price drops, akin to the phenomenon known as "Dutch Disease" (Flamos et al., 2013). This economic condition, characterized by reduced export competitiveness after a significant influx of capital from gas exports, has been linked to adverse effects on national economies (Hien, Hong Vinh, Phuong Mai, & Kim Xuyen, 2020). Numerous studies emphasize the importance of a diversified economy for hydrocarbon-based nations, acknowledging the impact of Dutch Disease on financial development and economic stability (Adetutu, Odusanya, Ebireri, & Murinde, 2020; Parcero, 2019). These consequences include limitations in integrating commodities into other sectors, governance issues, challenges in managing financial and human resources, and the prevalence of rent-seeking behavior.

1.1. Problem Statement and Research Goal

In the dynamic landscape of global innovation, hydrocarbon-based economies face a critical challenge in transitioning from resource dependency to knowledge-driven sustainability. The traditional reliance on finite natural resources, exemplified by oil and gas, poses economic vulnerabilities to fluctuations in commodity prices, necessitating a shift toward diversified and knowledge-centric models. This transformation is imperative for sustained economic growth, mitigating risks associated with oil price dependence, and fostering resilience in the face of economic uncertainties. However, despite global recognition of the importance of knowledge-based economies, hydrocarbon-dependent nations grapple with economic diversification, educational reform, and technological integration complexities. Addressing these challenges is paramount to securing the long-term viability and success of nations seeking to escape the resource curse and embrace sustainable economic and educational paradigms.

This research aims to examine the challenges hindering economic sustainability in hydrocarbon-based economies and identify imperatives for innovation. The study aims to provide insights into transitioning from resource dependency to knowledge-driven sustainability. This research innovatively explores the intersection of economic sustainability and innovation challenges in hydrocarbon-based economies, offering a comprehensive analysis. It contributes novel perspectives on imperative strategies, fostering a paradigm shift towards sustainable and diversified economic models in the face of hydrocarbon market uncertainties through direct interviews with a diverse number of business and academic sector experts from several organizations.

1.2. Research Structure

This study spans five chapters, each contributing to a profound comprehension of innovation ecosystems and the economic sustainability of hydrocarbon-based economies. Our exploration begins with Chapter 1's contextual introduction, establishing the foundation for investigating the present state of innovation, education, and economic sustainability, along with the background of hydrocarbon-based economies. This chapter articulates the problem statement and research goal concerning hydrocarbon-based economies' challenges in transitioning to knowledge-driven sustainability, emphasizing the imperative to explore innovation, education, and economic diversification. In Chapter 2, the literature review examines the influence of hydrocarbon price fluctuations on economies, underscoring the necessity for diversification. It explores topics such as the resource curse, economic diversification, ecosystem frameworks, innovation, and Technology Transfer (TT) in hydrocarbon-based nations. The challenges of the Gulf Cooperation Council (GCC) and Qatar's initiatives, including the Qatar National Vision 2030 (QNV 2030) and government programs, are discussed. Chapter 3 outlines the research design, encompassing data collection, interview methods, and interview structure. This study employs a qualitative case study approach with semi-structured interviews to explore innovation in Qatar's hydrocarbon-based economies comprehensively. Chapter 4 presents an in-depth analysis of the main results and a discussion of the feedback obtained from business and academic interviews. Finally, Chapter 5 concludes with a comprehensive summary of key findings and recommendations for future research.

2. Literature Review

It is now well established that hydrocarbon price variations can impair the sustainability of hydrocarbon-based economies. However, as per Kong (2012), observations have indicated that in the Singapore economy success development case, policy subsystem and policy instrument approaches provided an integrated business development framework that considered political context and policy considerations. Lack of diversification in these hydrocarbon-based economies has existed as an economy sustainability problem for many years; for example, as per Mishrif (2018), most of the GCC strategies and development plans have identified economy diversification as a vital factor of economic sustainability due to depleted reserves of hydrocarbons.

Hydrocarbon-based economies have been deeply debated in recent years, and many researchers and economists have stressed the fundamental role governments play in escaping the resource curse and changing it positively. According to Elbra (2013), the resource curse can be defined as "the paradox by which mineral-rich states fail to keep pace, economically, with their non-mineral-rich peers". On the other hand, Dadgar and Orooji (2020) defined it as mismanagement and waste of natural resources. As per Kassouri, Altıntaş, and Bilgili (2020), the fluctuation of oil prices significantly impacts stock returns, inflation rate, economic output, industrial production, exchange rate, investment expenditure, and bank performance. Evidence suggests that a diversified knowledge economy is among the most important factors for a sustainable economy (Schilirò, 2013).

This research provided an important opportunity to advance the understanding of a more sustainable economy and take advantage of the current high income from hydrocarbon to put a clear plan on how to avoid the high dependency on it as the main revenue source. Shreds of evidence suggest that economic sustainability is among the most important factors for a country's success, as stated by Dadgar and Orooji (2020), "Owning Natural resources has been beneficial for some Countries, but hurtful for some others" as it's all depend on the country strategy on utilizing these resources wisely.

2.1. Resource Curse

The resource curse, a paradox observed in nations with abundant non-renewable natural resources like oil, leads to economic stagnation or contraction. Extensive research, particularly in oil-rich countries, delves into the intricacies of this phenomenon. Kassouri et al. (2020) focused on the financial resource curse hypothesis in oil-exporting countries, exploring the threshold effect of democratic accountability. Their findings revealed that democratic accountability plays a crucial role

in mitigating the financial curse, with proper institutions aiding in responsible financial management derived from oil sales.

Examining the impact of the 1970s oil price boom and subsequent bust, Smith (2019) coined the term Dutch disease. Manufacturing exports flourished during the boom, attributed to government policies promoting industrialization, while agricultural exports suffered from limited investment. Dadgar and Orooji (2020) associated the Dutch disease with governance issues, highlighting its varying impact on different countries.

Adetutu et al. (2020) investigated the resource curse in oil-rich countries, observing a decline in banks' total productivity factor during oil booms in Kazakhstan, indicating poor economic performance. Göçer (2016) identified oil price fluctuations as another factor affecting oil-exporting nations' economic performance, demonstrating a direct correlation between price increases and national income growth. However, this holds true for nations overly dependent on oil. With resource-rich countries facing economic uncertainty due to dependence on a single resource, Göçer (2016) advocates for economic diversification to mitigate the impact of oil price fluctuations and reduce vulnerability to the resource curse.

2.2. Economic Diversification

Economic diversification, the process of transitioning from a single income source to multiple sources, is a concept explored in various studies. Aitzhanova et al. (2015) projected a decline in oil production in Kazakhstan after 2035 based on proven reserves, urging the need for diversification to ensure long-term economic sustainability. Schilirò (2013) focused on the UAE, emphasizing the vulnerability of its oil-dependent economy to price fluctuations. Proposing a shift towards a knowledge economy, Schilirò suggested investments in higher education, business services, and technology development to cushion against oil price volatility.

Matallah (2020) examination of Middle East and North Africa (MENA) oil exporters revealed a positive correlation between oil rents and growth, emphasizing the role of governance in economic diversification. According to Matallah (2020), good governance is crucial for implementing policies that reduce budget deficits, enhance public expenditure management, and improve spending efficiency, addressing economic diversification and the resource curse. Despite these efforts, Flamos et al. (2013) suggested that oil remains the primary driver of GCC economies, indicating a need for further diversification to lessen dependence on oil.

2.3. Ecosystem Framework

In the pursuit of economic diversification, oil-rich nations, while making strides in reducing their reliance on oil, still grapple with the challenge of creating a robust ecosystem framework. This framework is essential for ensuring responsible resource production and utilization, aligning with societal and environmental benefits. Sun, Wu, and Yang (2018) advocate for a systematic thinking ecosystem framework in the context of business sustainability, emphasizing the interdependence between business operations and the environment. Applied to oil-rich countries, this approach can guide oil production methods that prioritize societal and environmental well-being.

Exploring innovation ecosystems, Xu, Wu, Minshall, and Zhou (2018) focus on 3D printing in China, showcasing its impact on science and technology. When applied to oil-dependent nations, this innovation ecosystem holds the potential to drive advancements in science, technology, and research, facilitating the transformation of these nations into knowledge-based economies (Wallner & Menrad, 2011). Su, Kajikawa, Tsujimoto, and Chen (2018) further underscore the significance of innovation ecosystems in value creation, particularly in improving business performance through technological development.

Mortati and Maffei (2018) examine European design policy ecosystems, proposing a model that identifies existing policy instruments and maps organizations supporting these policies. This model can be instrumental for oil-rich countries to evaluate existing policies in the context of resource curse and economic diversification. Isenberg (2011) introduces the entrepreneurship ecosystem strategy as a paradigm for economic policy, emphasizing the need for geographically concentrated ecosystems

conducive to entrepreneurship. This strategy, if adopted by oil-dependent countries, can serve as a catalyst for economic diversification and improved sustainability.

2.4. Innovation and Technology Transfer

Innovation and TT stand as crucial factors facilitating economic diversification and the establishment of effective ecosystem frameworks in oil-rich nations. TT involves the movement of new technology from developers to secondary users, often occurring from developed to developing countries. García-Vega and Vicente-Chirivella (2020) study delves into the impact of TT from universities on firm innovation, revealing a substantial increase in innovativeness, particularly among small businesses. This underscores the pivotal role of technology in fostering innovation within companies.

Wonglimpiyarat (2016) examination of university business and innovation incubators highlights these programs as major policy mechanisms supporting innovation, acting as intermediaries between academia and industry. Such incubators facilitate the effective utilization of university research, contributing to entrepreneurial development. Similarly, Steruska, Simkova, and Pitner (2019) explore the influence of science and technology parks on TT, showcasing their role in creating spaces for knowledge exchange between companies, markets, and universities, ultimately enhancing research quality and driving innovation.

Phillips (2002) scrutinizes the impact of technology business incubators on TT effectiveness, revealing variations influenced by legal structures, conflict of interest policies, and diverse requirements. Depending on their design, these factors act as either promoters or barriers to TT.

In the realm of public TT, Min, Kim, and Vonortas (2020) identify key influencers of commercialization, including market competition, the absorptive capacity of the recipient company, effective technology supplier-recipient partnerships, and internal innovation capabilities. High absorptive capacity, a competitive market, and strong partnerships positively impact the commercialization of public TT, subsequently enhancing business growth (Ungureanu, Pop, & Ungureanu, 2016). This collective research emphasizes the interconnectedness of innovation and TT in fostering economic growth and diversification.

2.5. Gulf Cooperation Council and Qatar's Ecosystem

The GCC nations, including Qatar, grapple with the resource curse and the imperative for economic diversification. Researchers, exemplified by Faghih and Sarfaraz (2014), focus on Qatar's innovation dynamics in its transition to a knowledge-based economy. Positive aspects include political stability, inbound tertiary mobility, and industry-university research collaborations. Yet, deficiencies in education, science expenditure, knowledge absorption, and scientific publications signal areas for improvement, as suggested by Abdulwahed (2017). Aljawareen (2017) analysis of innovation in GCC countries identifies obstacles: inadequate research and development (R&D) investment, limited high-tech exports, and low employment in knowledge-intensive activities. Abdulwahed and Hasna (2017) emphasize education and research investment in transforming resource-dependent economies into knowledge-based ones. Mohtar (2015) explores innovation opportunities and challenges in Qatar, highlighting political goodwill, capital investment, Science and Technology Park creation, and research strategy. Challenges include capacity-building gaps, merit neglect, and instability among scientists, limiting innovative idea generation. Ibrahim and Harrigan (2012) trace Qatar's economic evolution, which was initially oil-dependent. Post-1970s oil production peak, Qatar confronted declining oil fields, prompting a shift toward an innovative ecosystem for economic diversification. Cevik (2014) examination of GCC sans oil underscores limited investment in non-hydrocarbon sectors, exposing them to asymmetric shocks. Policy interventions are essential to mitigate economic vulnerabilities when oil prices decline. This collective research underscores the critical need for innovation, education, and diversified economic policies in addressing the challenges faced by oil-rich GCC nations like Qatar.

2.6. Innovation of Hydrocarbon Economies

Innovation emerges as a crucial factor in addressing the challenge of economic diversification and the resource curse in hydrocarbon economies. Considering this, Ben Hassen (2020) scrutinizes Qatar's economic diversification dynamics, spotlighting Information and Communications Technology (ICT), innovation, and entrepreneurship. Over the past two decades, Qatar has committed substantial investments to cultivate an innovation ecosystem marked by establishing R&D institutions. This strategic emphasis on innovation has been pivotal in Qatar's gradual evolution from a resource-centric to a knowledge-based economy.

Examining the broader context of GCC countries, Miniaoui and Schilirò (2017) underscore the significance of innovation and entrepreneurship as prime drivers of economic diversification. Notably, GCC nations have instituted innovation programs, signaling a shift towards knowledge-based economies. In a study by Tok (2020) exploring Qatari residents' attitudes toward innovation, a degree of aversion is identified. This reluctance is attributed to Qatar's resource-dependent economic structure and a lack of prior experience with innovation among citizens. Despite the pivotal role of innovation in transforming Qatar into a knowledge-based economy, Tok (2020) suggests limited citizen engagement in innovation activities.

Shifting the focus to Saudi Arabia, Hassan (2020) delves into the kingdom's economic diversification, emphasizing the transformative influence of Artificial Intelligence (AI). AI emerges as a potent force propelling Saudi Arabia toward becoming a technological hub, illustrating the transformative impact of technological innovation on hydrocarbon economies. Concluding the thematic exploration, Asheim (2015) draws attention to Kuwait's oil dependence and advocates for economic diversification. Identifying innovation as a primary driving force, Asheim (2015) underscores the need for policy frameworks supporting innovation to diversify Kuwait's economy successfully. Collectively, these studies underscore the pivotal role of innovation in steering hydrocarbon economies from resource-centric to knowledge-based paradigms.

2.7. QNV 2030: Strategies for Transformation

The developmental trajectory of Qatar is undergoing unprecedented growth, with the QNV 2030 delineating three pivotal and interconnected goals to steer policymaking in the ensuing decades (Ministry of Development Planning and Statistics, 2015). These goals encompass the maintenance of a high standard of living for all Qatari citizens, promoting and expanding domestic capacity for innovation and entrepreneurship, and aligning economic outcomes with economic and financial security. Emphasizing the imperative of economic diversification, QNV 2030 underscores the gradual reduction of dependence on hydrocarbon industries and the elevation of the private sector's role. Key elements include expanding industries and services derived from hydrocarbon industries, specialization in economic activities, and cultivating a knowledge-based economy characterized by innovation, entrepreneurship, education excellence, robust infrastructure, efficient public services, and transparent governance.

To realize this ambitious vision, Qatar relies on the National Development Strategy, positioning it as the vehicle to ensure unprecedented standards of living for all its citizens, fostering their potential across gender and age groups. Aligned with the National Economic Strategy, Qatar has initiated various projects aimed at catalyzing its transition into a sustainable economy. Noteworthy initiatives include boosting the value of Qatar's productive base, enhancing economic stability, improving technical efficiency, and fostering economic diversity (Ministry of Development Planning and Statistics, 2015).

The National Strategy's core pillar delineates a long-term economic and environmental sustainability plan. The strategy seeks to diversify Qatar's economy beyond the oil and gas sector, ensuring controlled growth and environmental preservation. A key focus lies in developing world-class infrastructure to maintain Qatar as a premier destination for regional and international visitors and investors, culminating in hosting the highly anticipated 2022 World Cup (Qatar General Secretariat for Development Planning, 2011).

2.8. Qatar Government Initiatives

In line with the QNV of building a strong industrial production base, supporting the local Qatari product to achieve balanced economic growth, away from oil revenues as a major source of income and diversification of its sources, as well as increasing the contribution of the industrial sector to GDP, there were many initiatives which have been established. The State of Qatar has been keen to provide a promising investment environment in the important sectors of the national economy and to provide it with an administrative and legislative system that stimulates business practice characterized by a legislative framework suitable for business development and attracting investments and the issuance of many laws aimed at stimulating and attracting local investments. The Qatari government has adopted a policy of preventing double taxation by concluding agreements with more than 70 countries, with the aim of reducing the tax burden on the investor.

2.8.1. Single Window

There was a big challenge in previous issuing approvals procedures that required the intervention of more than 40 relevant departments in government authorities involved in this process. Pointing out that this electronic platform will contribute to connecting the investor to about 18 government agencies in one place, thus integrating all the procedures of establishing in a comprehensive procedure shortens all steps of the establishment. This leading national initiative aims to facilitate business creation and direct investment flows to the priority sectors identified in the 2018-2022 National Development Strategy (Planning and Statistics Authority, 2018).

The Single Window initiative is targeted to provide a unified and integrated electronic platform for investors and facilitate the procedures for granting the necessary approvals and licenses to establish business in Qatar. It was inaugurated in 2019, which contributes to attracting more domestic and foreign investments and ensures the flow and ease of establishing investment projects in the country and directing them towards sectors that serve national priorities at the development level.

2.8.2. Qatar Development Bank

There are several initiatives by the Qatar Development Bank to support small and medium enterprises (SME) engineering projects through engaging special projects co-funded by Qatar Development Bank (QDB) and government entities in certain sectors, such as tourism, education, industrial, healthcare, residential and commercial sectors. QDB offers several initiatives to support SMEs and entrepreneurs, including Jahiz for leasing manufacturing facilities, Ithmar for Sharia-compliant institutional investment, Business Consultancy for project establishment, Entrepreneurship Leave Program allowing government employees to focus on their businesses, and CO-Working Office Space, a cost-effective incubation program providing shared office spaces for startups. These initiatives aim to foster innovation, provide financial support, and facilitate the growth of businesses in Qatar (Qatar Development Bank, 2023).

2.8.3. Manateq

Established in 2011, Manateq is responsible for managing the Manateq regions and building infrastructure to the highest international standards to facilitate the growth of the industry and services sectors, which contribute to the achievement of economic development goals as one of the four pillars of QNV 2030 (Ministry of Development Planning and Statistics, 2015). Manateq provides logistics services, industrial zones, and storage areas to investors with a wide variety of customer services, advanced infrastructure, and easy-to-establish procedures, as well as securing the necessary access to the Gulf and international markets and many other services.

2.8.4. Qatar Free Zone Authority

Qatar Free Zone Authority (QFZA), established in 2018, is a regulatory body established to promote economic diversification and attract foreign investment in Qatar. Designed to facilitate international businesses, QFZA oversees free zones, providing a conducive environment for trade and innovation. The authority offers incentives such as tax exemptions, streamlined administrative

processes, and business-friendly regulations to enhance the ease of doing business. Through strategic initiatives, QFZA contributes to the realization of Qatar's economic goals outlined in the National Vision 2030, fostering sustainable development and positioning Qatar as a competitive global business hub. The free zones overseen by QFZA aim to drive economic growth and diversification across various sectors (Qatar Free Zone Authority, 2018).

2.8.5. Intangible Investment

World-class infrastructure in the heart of the Gulf, exemplified by landmarks such as Hamad International Airport, which was inaugurated in 2014, contributes significantly to Qatar's standing in the regional and global economic and tourism sectors. Hamad Port, inaugurated in 2017, signifies a pivotal shift towards achieving economic diversification and enhancing Qatar's competitiveness, aligning with the objectives outlined in QNV 2030.

The extensive highway network further strengthens the country's infrastructure, while Qatar Rail plays a crucial role in supporting the national strategy and vision by catalyzing significant economic growth through its expansive rail network. In the healthcare sector, strategically located hospitals equipped with the highest standards of healthcare facilities and well-distributed staffing effectively meet current and anticipated demands in Qatar.

Accredited colleges and universities play a pivotal role in providing quality education to students, ensuring that residents and citizens have access to a diverse range of majors and minors across various disciplines, and fostering a fair and inclusive educational environment. Qatar has instituted various innovation and development platforms across sectors, including energy, environment, transport, research funding, education, and more. Figure 1 illustrates the comprehensive innovation and development system in Qatar.

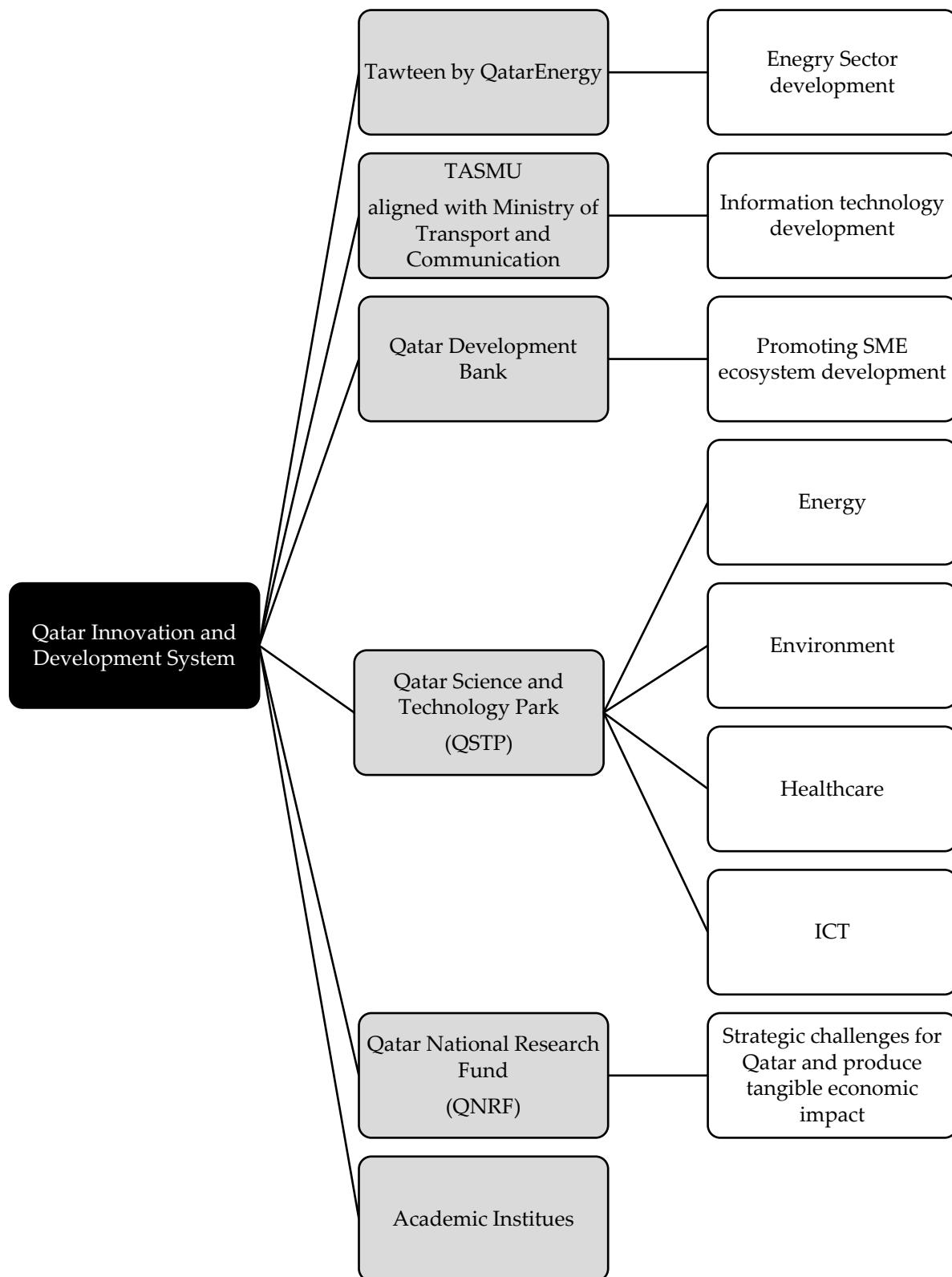


Figure 1. Qatar innovation and development system.

The literature review provides insights into the existing state of innovation ecosystems and highlights the challenges faced by hydrocarbon-based economies, particularly Qatar, in managing resource dependency and navigating oil price fluctuations. Key findings underscore the adverse

impact of the resource curse, underscoring the urgency of economic diversification. Recognizing a gap in current diversification efforts, the research proposes a comprehensive approach. This involves sustained initiatives for economic diversification, a nuanced understanding of innovations in education and business, and the active involvement of diverse stakeholders from various organizations within the community. The aim is to seize opportunities, address challenges, and formulate a robust innovation ecosystem strategy framework that ensures adaptability to emerging opportunities and challenges.

3. Methodology

In exploring the intricacies of innovation in Qatar's hydrocarbon-based economies, our research employs a qualitative case study approach. Through semi-structured interviews with business and academic professionals, we aim for depth and diversity. This research ensures comprehensive insights into innovation strategies and challenges. With an organized interview structure covering focus groups, opportunities, and challenges, we seek a nuanced understanding. Figure 2 presents this research methodology, which is divided into four stages.

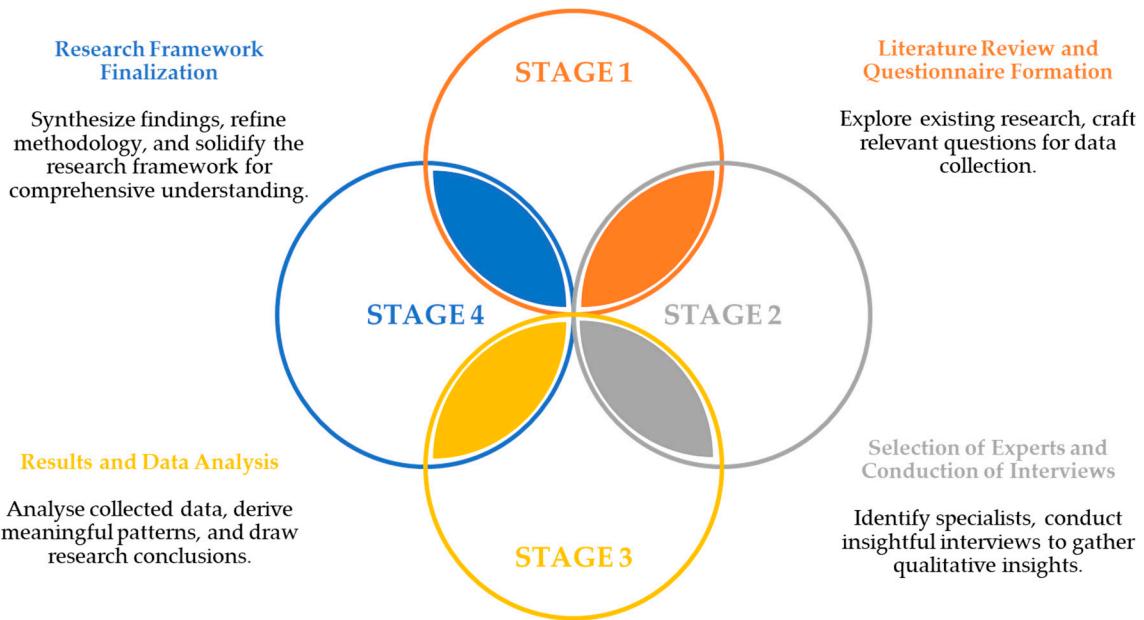


Figure 2. Research method.

3.1. Research Design

To research the processes of developing a framework business model in an innovation ecosystem for hydrocarbon-based economies, we took a qualitative research approach using a case study methodology. This enabled us to gain in-depth insight into how the innovation ecosystem's actors manage the tensions over time for several disciplines. The phenomena we studied are innovation ecosystems in which cross-sector actors develop innovative sustainable business models for hydrocarbon-based economies. The research design chosen for this study is a qualitative approach, aiming to explore and understand the perceptions and experiences of both business and academic professionals regarding innovation in Qatar. Qualitative research is appropriate for gaining in-depth insights into complex phenomena such as innovation strategies and challenges (Creswell & Creswell, 2017). The use of semi-structured interviews allows flexibility in gathering detailed responses while maintaining a certain level of consistency across participants. This approach enables the exploration of participants' subjective viewpoints on innovation, providing a rich and comprehensive dataset (Ortiz & Greene, 2007).

3.2. Data Collection

The primary data collection method is through semi-structured interviews conducted with two distinct groups: business professionals, represented by 5 participants, and academic professionals, represented by 11 participants. Each interview, with an average length of 60 to 90 minutes, was recorded and transcribed accurately. This purposive sampling strategy ensures representation from diverse sectors within Qatar, enhancing the generalizability of findings. The choice of interviews over other methods, such as surveys, is motivated by the need to capture detailed and nuanced responses, allowing for a deeper understanding of the participants' perspectives on innovation in Qatar (Rubin & Rubin, 2011). The round of interviews was conducted in January and February 2022 for a total period of two weeks. The interview questions are clearly mentioned in Appendix A. Appendix B and Appendix C provides an analysis of business and academic entities and individuals involved in the interview-based research. The interviews included 8 outstanding organizations locally in the State of Qatar and externally as well.

3.3. Interview Method

The semi-structured interviews provide a balance between predefined questions and the flexibility to explore emerging themes (Patton, 2014). The participants were selected based on their expertise and experience in Qatar's different companies and academic sectors. The sample size is considered sufficient for qualitative research, as it allows for saturation, where new insights become redundant, indicating that enough perspectives have been gathered to address the research questions adequately.

The analytical process consisted of three stages combining strategies for analyzing process data. The interview data analysis stage involved a detailed reading of the interview transcripts and documents and viewing the audiovisual material. This resulted in deep discussions with the participants, focusing on the feedback relevant to their area of expertise during their experience, as well as professionals developing, understanding, and maintaining the innovation ecosystem for hydrocarbon-based economies in addition to the current educational motivation and research.

3.4. Interview Structure

The interview structure is organized into three main sections: focus group questions, opportunity questions, and challenges questions. Each section is designed to comprehensively explore specific aspects of innovation in Qatar. The focus group questions aim to define and understand participants' perceptions of innovation, covering its definition, approach, significance, common pitfalls, and strategies for development in Qatar. On the other hand, the opportunity questions focus on participants' visions for the future of innovation in Qatar, considering the role of education, institutions like Qatar Science & Technology Park (QSTP) / Qatar Research, Development, and Innovation (QDRI), and the opportunities arising from Qatar's position as a leading Liquified Natural Gas (LNG) producer. Lastly, the challenges questions explore the challenges faced by Qatar's innovation ecosystem, participants' views on the existence of an innovative ecosystem, and their expectations regarding its components, drawing inspiration from the UAE's innovation policy.

This methodological approach is intended to provide a comprehensive and nuanced understanding of innovation in Qatar, taking into account the perspectives of both business and academic professionals.

4. Results and Discussion

4.1. Business Experts Interviews

4.1.1. Focus Group Questions

The responses to Question 1 underscore a holistic perspective of innovation, emphasizing its multifaceted nature, role in continuous improvement, and problem-solving. Key findings include associating innovation with practical solutions and adaptability, highlighting its transformative potential and tangible impacts, including financial benefits. Technology is recognized as integral,

with Business Expert 5 (BE 5) emphasizing "smart ways" of problem-solving. This holistic view aligns innovation with value creation.

Question 2 reveals diverse approaches to innovation. BE 1 focuses on business-centric innovation, while BE 2 emphasizes collaboration and inclusive methods. BE 3 adopts a continuous, iterative approach, and BE 4 emphasizes collaborative problem-solving. BE 5 brings a user-centric perspective, emphasizing understanding consumers and emerging problems linked with technological advancements.

Question 3 showcases the significance of innovation from various angles. BE 1 underscores its existential importance for organizational endurance, citing benefits like better solutions, cost-effectiveness, and sustainability. Other participants echoed the importance of meeting customer needs, achieving cleaner practices, and ensuring industry relevance through innovation. BE 5 broadens the impact of lifestyle improvements, time management, and simplifying complexities.

Responses to Question 4 highlight factors contributing to innovation initiative failures. BE 1 emphasizes the importance of clearly defining problems and understanding stakeholders. BE 2 identifies misalignment between customers and providers and issues related to market size. BE 3 stresses the need for a supportive ecosystem and the right mindsets. BE 4 emphasizes adaptability, and BE 5 provides a nuanced perspective, stating that innovation itself doesn't fail but acknowledges challenges in fulfilling objectives.

Question 5 participants provide diverse insights into measuring innovation through Key Performance Indicators (KPIs). BE 1 suggests a holistic approach, incorporating performance, technology, and economic factors. BE 2 proposes measuring success based on project stages. BE 3 focuses on functionality, and BE 4 suggests measuring innovation through growth. BE 5 links KPIs to market attraction and adoption of new processes, emphasizing a comprehensive set of KPIs.

Question 6 participants offer insights into developing an innovation strategy for Qatar. BE 1 emphasizes alignment with national priorities, research, and education quality. BE 2 highlights manpower, skill development, and tools. BE 3 acknowledges time limitations but implies a focused approach. BE 4 roots innovation strategy in a solid economic foundation, while BE 5 introduces the idea of allowing space for failure.

Question 7 insights into the strengths and challenges of Qatar's innovation ecosystem are provided by participants. BE 1 identifies strengths like a clear vision and resource availability, noting challenges in linking education/research institutes with industries. BE 2 highlights good infrastructure and a strong educational system but points out challenges related to limited local competency. BE 3 emphasizes diversity and an open community but notes challenges in regulations, high costs, and the absence of world-leading companies. BE 4 outlines strengths in internet availability and a large education sector but lists challenges related to a lack of robust innovation processes and anchor companies. BE 5 identifies wealth as a strength and challenge in the education system and local focus.

Question 8 participants provide insights into enhancing Qatar's national innovation ecosystem. BE 1 emphasizes collaboration and talent, drawing inspiration from successful cases. BE 3 identifies areas for enhancement, including policies, regulations, and private sector involvement. BE 4 underscores building a national innovation infrastructure. BE 5 proposes enhancing the ecosystem through competition, initiatives, and engagement with society.

Question 9 explores skills crucial for enhancing innovation and balancing creativity with functionality. BE 2 emphasizes open-minded discussion and achieving balance through KPIs. BE 3 identifies communication and collaboration skills as essential. BE 4 stresses finding talent with the right mindset. BE 5 highlights motivation, market awareness, and problem-solving, recommending a purpose-driven approach.

For Question 10, participants, particularly focusing on SMEs, emphasize the role of innovation in product development and business processes. BE 2 suggests increased investment, research, and support for businesses with innovative ideas. BE 3 underscores the roles of innovation in enhancing performance and maintaining competitiveness, advocating for increased awareness and collaboration. BE 4 highlights the pivotal role of innovation in dominating the market, recommending

an open-minded approach. BE 5 identifies a key challenge: the reluctance of businesses to allow space for experimentation and failure.

Question 11 responses emphasize the importance of fostering a culture of discussion to enhance innovation, creativity, and competitiveness. BE 3 suggests that open dialogue about challenges contributes to continuous improvement. BE 4 advocates for the establishment of a dedicated R&D department, emphasizing the importance of a specialized unit focused on innovation. BE 5 stresses allocating dedicated time for innovation and integrating new features and ideas into daily business operations.

These summaries collectively offer comprehensive insights into the multifaceted nature of innovation, diverse approaches, its significance, challenges, and strategies to foster a thriving innovation ecosystem in Qatar. The participants' perspectives highlight the complexity and importance of innovation across various sectors and underscore the need for collaborative efforts, strategic planning, and a supportive environment to propel innovation forward in the country.

4.1.2. Opportunity Questions

In response to Question 12, participants envision a transformative change in Qatar's innovation landscape by 2030. BE 3 foresees significant sectoral leadership with a focus on health, sport, and energy. BE 4 emphasizes completing structural foundations for innovation, projecting Qatar as a leader in innovation by 2030. BE 5 acknowledges Qatar's ambition but highlights the challenge of developing an action plan and the predominant reliance on oil and gas. This collective ambition emphasizes sectoral leadership, infrastructure development, and economic diversification as key goals for the transformation of Qatar's innovation landscape by 2030.

Question 13 explores the impact of Qatar's higher education sector on innovation. BE 2 sees the sector's expansion as supportive, emphasizing competence, knowledge delivery, and the need to push high-level education strategies down. BE 3 links higher education to R&D, knowledge, and understanding. BE 4 underscores the human-centric nature of innovation, emphasizing the critical role of education and specialized individuals. BE 5 concurs, highlighting the advantages of higher education in fostering innovation and creativity. The collective insights highlight the positive impact of higher education on fostering innovation through competence, knowledge, specialization, and human development.

In response to Question 14, participants highlight the instrumental role of QSTP/QRDI in supporting innovation. BE 2 emphasizes its support for startups, communication facilitation, and provision of facilities. BE 3 recognizes its strategic role in creating collaborations. BE 4 identifies QSTP/QRDI contributions in bringing together an ecosystem, making talent available, and funding R&D. BE 5 commends QSTP for its leading position and strategic support for innovation. These insights underscore the instrumental role of QSTP/QRDI in supporting startups, fostering collaborations, and providing resources to enhance innovation in Qatar.

Question 15 explores the role of incubators in enhancing and encouraging innovation. BE 2 highlights their assistance to small startups, especially with initial ideas. BE 3 sees incubators as minimizing idea failure providing a supportive environment. BE 4 emphasizes its benefits for non-experienced entrepreneurs, offering valuable knowledge buildup. BE 5 underscores logistical support from incubators, advocating for increased financial engagement. These insights highlight the supportive role of incubators in assisting startups, minimizing failure, and providing knowledge with a call for increased financial support.

For Question 16, BE 2 suggests evaluating progress by tracking successfully converted projects. BE 3 emphasizes assessing projects' contribution to the economy. BE 4 proposes a multifaceted approach, evaluating growth in aspects like daily active users and revenue. Collectively, these insights stress tangible outcomes, economic contributions, and comprehensive metrics as key indicators for evaluating innovation progress.

In response to Question 17, BE 2 sees an opportunity for Qatar to lead in sustainable energy as the largest LNG producer. BE 3 highlights Qatar's potential in technological advancements and renewable energy. BE 4 suggests connecting buyers with the spot market as an opportunity. BE 5

proposes innovation by providing local companies with laboratories, emphasizing the need for a higher budget dedicated to innovation. These insights collectively underscore Qatar's potential to lead in sustainable energy, technology, and innovation within the LNG sector.

These responses collectively provide a nuanced understanding of Qatar's aspirations, challenges, and strategic directions in fostering innovation, emphasizing sectoral leadership, higher education's impact, the instrumental role of QSTP/QRDI, support from incubators, comprehensive evaluation metrics, and Qatar's potential in sustainable energy and technological advancements.

4.1.3. Challenges Questions

In response to Question 18, BE 2 identifies challenges in Qatar's education system, emphasizing the need for innovation to be introduced at school levels and advocating for cultural change. BE 4 points out challenges related to Qatar's small market size, lack of education, and difficulties in identifying problems requiring innovative solutions. BE 5 did not provide a specific answer. These insights collectively underscore challenges in education, cultural norms, market size, and problem identification, highlighting the multifaceted obstacles faced by Qatar in fostering innovation.

For Question 19, BE 2 and BE 3 acknowledge the absence of a fully matured innovative ecosystem in Qatar, with BE 2 stating that Qatar does not have one yet and BE 3 noting the lack of maturity but possessing the right components. BE 4 agrees that Qatar currently lacks a mature innovative ecosystem. BE 5's response that there is no innovative ecosystem in Qatar. BE 5 suggests a nuanced perspective, indicating a preference for the development of an innovative ecosystem. These responses collectively signal the recognition of the need for further development and maturation of Qatar's innovation ecosystem, expressing varying degrees of optimism about existing components and growth potential.

4.2. Academic Experts Interviews

4.2.1. Focus Group Questions

In response to Question 1, diverse perspectives on defining innovation emerge. Academic Expert 1 (AE 1) emphasizes innovation as anything new adding value financially or socially. AE 2 envisions innovation fostering a knowledge-based economy with societal impacts. AE 3 links innovation to entrepreneurship for problem-solving. AE 4 categorizes innovation into product, process, and market-based, emphasizing financial value. AE 5 focuses on engineering modifications for system improvement. AE 6 sees innovation for societal, economic, and technical benefits. AE 7 stresses transforming for societal improvement, while AE 10 distinguishes between creativity, invention, and innovation, noting the latter's societal impact.

For Question 2, approaches to innovation are varied. AE 1 emphasizes layers and strategic thinking. AE 2 outlines challenges, global market access, and creating ecosystems. AE 3 focuses on educating innovative graduates and advocating for teaching philosophy changes. AE 7 emphasizes customer feedback, brainstorming, and stakeholder engagement. AE 8 stresses changing products for meaningful transformation. Collectively, these perspectives underscore the multifaceted nature of approaching innovation, encompassing strategic thinking, problem-solving, education, and collaboration.

Regarding Question 4, the focus is on reasons for the failure of innovation initiatives. AE 1 highlights strategy, processing, knowledge management, and human resources failures. AE 2 points to alignment issues, lack of leadership support, funding struggles, an unsupportive ecosystem, and a lack of competitiveness. AE 3 identifies market and risk analysis failures, suggesting ties with the ICT industry. AE 10 emphasizes cultural challenges, incomplete initiatives, lack of flexibility, and insufficient training. These insights highlight challenges ranging from strategic and cultural to market alignment and leadership support.

In response to Question 5, diverse perspectives on measuring innovation through KPIs emerge. AE 1 emphasizes process measurement, tracked ideas, implemented ideas, and generated value. AE 2 focuses on patent filings, research conversion, and time spent on research. AE 7 emphasizes

customer satisfaction, market competitiveness, and gaining new markets. AE 10 introduces the Landscape Engagement Output Impact framework (LEOI) for measuring innovation. These insights showcase the multifaceted nature of innovation measurement, ranging from process-centric indicators to domain-specific and impact-focused metrics.

For Question 9, AE 1 recommends design thinking and structured approaches to balance creativity and functionality. AE 6 suggests an experimental approach, aligning with an iterative strategy for SMEs in Qatar's innovation ecosystem.

In Question 10, AE 1 emphasizes innovation roles in improving productivity and product quality for SMEs. AE 6 highlights the importance of new business models, citing their significant contribution to SMEs, aligning with innovation's role in optimizing operations and responsiveness.

In Question 11, AE 1 recommends assigning a dedicated executive for innovation, providing essential resources for a conducive environment. AE 6 suggests a comprehensive evaluation and creation of separate innovation units, emphasizing a strategic and multifaceted approach to fostering a culture of innovation.

These responses offer insights into the multifaceted nature of innovation, covering its definition, approaches, challenges, measurement, and strategic integration in various contexts.

4.2.2. Opportunity Questions

In response to Question 12, diverse perspectives on Qatar's 2030 innovation status emerge. AE 1, unfamiliar with the context, highlights a potential gap in understanding. AE 2 stresses the need for strategic plans in the next three years, while AE 3 envisions a surge in projects, indicating optimism. AE 4 emphasizes stringent monitoring for 2030 targets, emphasizing a structured approach. AE 5 acknowledges progress but urges comparing with other nations. AE 6 suggests a potential delay until 2040, citing human capital development challenges and advocating for long-term residency.

For Question 13, the expansion in Qatar's higher education sector is recognized as crucial for innovation. AE 1 emphasizes critical thinking skills and interdisciplinary collaboration. AE 2 sees education as an infrastructure for innovation. AE 4 asserts that without expansion, innovation cannot take center stage. AE 5 highlights the role of higher education in producing skilled engineers. AE 6 suggests curriculum design alignment with an innovation-based economy. AE 7 recognizes the dual nature of higher education. AE 11 emphasizes education as the backbone of innovation, and AE 10 underscores universities as pillars of the innovation system.

QSTP and QRDI play integral roles in enhancing innovation, as highlighted in Question 14. AE 1 emphasizes their role in knowledge transfer and commercialization. AE 2 acknowledges QSTP's role in commercializing innovation. AE 6 notes QSTP's focus on technological innovation. AE 7 stresses collaboration with universities and companies. AE 11 expresses dissatisfaction but acknowledges recent improvements. AE 10 notes the importance of innovation campuses and research parks.

Incubators and acceleration programs, crucial for fostering innovation, are emphasized in Question 15. AE 1 notes their role in promoting entrepreneurship and aiding idea validation. AE 4 emphasizes creating an attractive environment and consistency. AE 6 notes Qatar University's efforts in contributing to human capital and startups. AE 11 recognizes the role of physical spaces provided by incubators. AE 9 applauds incubators for creating networks. AE 2 and AE 8 did not provide specific insights. AE 10 acknowledges limited familiarity.

Question 16 explores metrics for measuring innovation progress. AE 1 suggests metrics such as incubators, innovation labs, and project and program numbers. AE 4 emphasizes using outcomes and periodic investigations. AE 6 suggests employing the Global Innovation Index and internal indexes. AE 11 proposes metrics like the success rate of supported companies. AE 9 focuses on the number of patents generated. AE 2, AE 3, and AE 5 did not provide specific insights. AE 10 emphasizes a brave and empowering approach.

Question 17 addresses opportunities arising from Qatar's status as the largest LNG producer. AE 4 highlights selling the product, diversification, and forecasting. AE 6 suggests exploring innovation in logistics and supply chain. AE 7 proposes a rapid transition towards clean and

renewable energies. AE 11 raises concerns about dependency on imported technology, suggesting a shift towards local technology. AE 9 stresses the need for increased focus on innovation. AE 10 highlights potential partnerships. AE 2, AE 3, AE 5, and AE 8 did not provide specific insights.

These responses collectively offer insights into the multifaceted nature of innovation in Qatar, covering perspectives on its status, higher education, key players, incubation, measurement, and opportunities in the context of Qatar's prominent LNG production.

4.2.3. Challenges Questions

In response to Question 18, AE 1 highlights challenges in Qatar's innovation ecosystem. The small population, market size, and complacency due to LNG leadership pose obstacles. AE 4 underscores governance and political system challenges, advocating for an innovation development department. AE 6 emphasizes human capital and collaborative culture, while AE 7 stresses the need for stronger university-company links. AE 9 underscores challenges related to research resources, policy implementation, accountability, and higher education costs, collectively contributing to the complexities Qatar's innovation ecosystem faces. However, AE 2, AE 3, AE 5, AE 8, AE 11, and AE 10 did not provide specific insights.

For Question 19, views on Qatar's innovative ecosystem vary. AE 4 sees it as a continuous process, emphasizing expansion and interconnection. AE 6 notes rapid evolution but acknowledges ongoing progress. AE 7 recognizes essential components but highlights the missing link. AE 11 acknowledges existing backbones but notes a lack of coherence. AE 10 agrees an ecosystem exists but is not fully matured. However, AE 1, AE 2, AE 3, AE 5, AE 8, and AE 9 did not provide specific responses.

Regarding Question 20, AE 1 outlines key components for a robust innovation ecosystem: a strong education system supported by incubation centers and programs nurturing startups. AE 3 emphasizes synchronization and execution. AE 4 underscores the need for a high-level organization promoting innovation. AE 5 stresses resources, facilities, and human capital. AE 6 highlights education, R&D support, startup assistance, and human capital development. AE 7 advocates collaboration and bridging strategies. AE 11 emphasizes clarity, defined roles, interaction, incentives, and a risk-tolerant environment. AE 9 focuses on sustainability and economic change anticipation. AE 10 underscores funding, gap analyses, and incubators as critical components.

5. Conclusions and Recommendations

In conclusion, this research has addressed the pressing problem of hydrocarbon-based economies, particularly Qatar, grappling with the challenges of resource dependency and the adverse impacts of oil price fluctuations. The main aim was to advocate for a paradigm shift towards diversified and knowledge-centric economic models to ensure sustainability. The novelty of this study lies in its comprehensive exploration of the intricate interplay between economic sustainability, innovation, and education within the context of hydrocarbon-dependent nations. The literature review unveiled the vulnerabilities faced by hydrocarbon-based economies, emphasizing the fragility of national economic cycles and the emergence of the resource curse as a significant challenge. Innovatively, the study delved into the multifaceted dimensions of economic diversification, addressing governance issues, societal well-being, and the need for robust ecosystem frameworks. Employing a qualitative case study methodology, the research examined Qatar's initiatives, such as the QNV 2030 and government programs, to reduce dependence on hydrocarbons and foster innovation. Semi-structured interviews with business and academic professionals provided nuanced insights into innovation strategies, challenges, and opportunities in the hydrocarbon-based context. Key findings underscored the holistic perspective of innovation, associating it with practical solutions, adaptability, and transformative potential. Diverse approaches to innovation, ranging from business-centric to collaborative and user-centric methods, highlighted the dynamic nature of the innovation landscape. Challenges in the education system, the imperative for a matured innovation ecosystem, and opportunities in sustainable energy were identified.

The research recommends sustained efforts in economic diversification, educational reform, and technological integration for hydrocarbon-based economies. Policymakers, businesses, and academics can leverage these insights to navigate the complexities of resource dependency and ensure long-term viability. The study motivates further exploration into sector-specific innovation strategies, considering evolving global trends, to support Qatar's growth as an innovation-driven nation. Looking ahead, future research endeavors should focus on specific sectors, incorporate evolving global trends, and explore the evolving dynamics of innovation in hydrocarbon-based economies. Additionally, investigating the effectiveness of implemented strategies, tracking long-term impacts, and evaluating the adaptability of the innovation ecosystem to emerging challenges would provide valuable insights for sustainable development. The commitment to addressing the challenges faced by hydrocarbon-dependent nations remains paramount, with a dedication to fostering economic diversity, innovation, and educational excellence for a resilient and prosperous future.

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Abbreviations

AE	Academic Expert
AI	Artificial Intelligence
BE	Business Expert
GCC	Gulf Cooperation Council
GDP	Gross Domestic Product
ICT	Information and Communications Technology
KPIs	Key Performance Indicators
LEOI	Landscape Engagement Output Impact framework
LNG	Liquified Natural Gas
MENA	Middle East and North Africa
QDB	Qatar Development Bank
QDRI	Qatar Research, Development, and Innovation

QFZA	Qatar Free Zone Authority
QNRF	Qatar National Research Fund
QSTP	Qatar Science & Technology Park
R&D	Research and Development
SME	Small and Medium Enterprises
TT	Technology Transfer

Appendices

Appendix A: Interview Questions:

Background: This section will cover the focus group questions

1. How do you define innovation?
2. How do you approach innovation?
3. Why does innovation matter?
4. Where do innovation initiatives/programs go wrong/fail
5. What is an innovation strategy? And from your experiences, how can you develop one for Qatar?
6. How do you measure innovation KPIs?
7. What are the biggest strengths and challenges with respect to the current Qatar innovation ecosystem?
8. At the national level, how can the innovation ecosystem be enhanced?
9. What are the most important skills for enhancing innovation in the national ecosystem? While innovating, how do you balance creativity and functionality? (Only for SMEs)
10. Does innovation play in business? If yes, then what is the role played? How can it be enhanced? (Only for SMEs)
11. How do you improve your company's Innovation, creativity, and competitiveness?

The following questions cover the opportunity questions:

12. How do you envision the status of Innovation in Qatar by 2030?
13. There was a significant expansion in Qatar's higher education sector during the last decade. Does this support Innovation?
14. What role does QSTP/QDRI play in enhancing and encouraging innovation?
15. What opportunities could this bring for Qatar, the world's largest LNG producer? How can these opportunities be enhanced?

The following questions cover the challenges questions:

16. What type of challenges does Qatar's ecosystem face to be innovative?
17. Is there an innovative ecosystem in Qatar? If not, Do you prefer to have one?
18. What type of components do you expect from it?

Appendix B: Analysis of Business Entities and Individuals Involved in the Interview-Based Research.

Organization	Characterization of organization	Interviewee	Role of the respondent(s)	Work area/main responsibilities of respondent(s)
A	Large, semi-government organization, operating on a growth market and fostering economic growth, and competing in the local and international markets.	BE 1		
		BE 2		
B	Medium, privately owned, operating in a growth market.	BE 3	<i>Founding Partner and CEO</i>	The owner is active in the company and has responsibility for daily work and strategic plans.
C	Medium, privately owned, operating in a growth market.	BE 4	<i>Co-Founder & CEO</i>	The proprietor actively engages in the company, overseeing both day-to-day operations and cooperate-level tasks.
D	Small, privately owned, operating in a growth market.	BE 5	<i>Founder and Managing Director</i>	Lead company operations, strategy, and overall management as founder and managing director.

Appendix C: Analysis of Academic Entities and Individuals Involved in the Interview-Based Research.

Organization	Characterization of organization	Interviewee	Role of the respondent(s)	Work area/main responsibilities of respondent(s)
E	Medium, privately owned, operating on a growth market.	AE 1	<i>General Manager and Co-founder</i>	Oversee operations, strategy, and innovation initiatives as General Manager, Co-founder.
F	Large, governmental-owned, operating on a growth market and fostering economic	AE 2	<i>CEO</i>	Directs the organization's strategies, operations,

Organization	Characterization of organization	Interviewee	Role of the respondent(s)	Work area/main responsibilities of respondent(s)
G	<p>growth, and entrepreneur in Qatar</p> <p>Large, government-owned, operating on a growth market and non-profit organization.</p>	AE 3	<i>Dean of College</i>	and financial activities effectively.
	AE 4	<i>Professor</i>	Academic leader, overseeing programs, faculty, and student affairs.	
	AE 5	<i>Associate Dean</i>	Educator, researcher, guiding students in engineering disciplines.	
	AE 6	<i>Director</i>	Guiding research and graduate studies, ensuring academic excellence and innovation.	
	AE 7	<i>Research Manager</i>	Leading innovation, entrepreneurship, and economic development initiatives with strategic vision.	
	AE 8	<i>Associate Professor</i>	Overseeing research projects, grants, and fostering academic innovation at the university.	
	AE 9	<i>Research Professor</i>	Teaching, researching, and contributing to civil and architectural engineering advancements.	
	AE 10	<i>Senior Innovation Advisor</i>	Conducting advanced materials research, innovating solutions, and contributing to academia.	

Organization	Characterization of organization	Interviewee	Role of the respondent(s)	Work area/main responsibilities of respondent(s)
				transformative initiatives successfully.
G	Medium, semi-government-owned, operating on a growth market and targeting to meet the country's vision.	AE 11	Head	Leading ICT initiatives, managing projects, and fostering technological advancements in the division.

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