

# Evolving Qatarization for Emerging Sectors: Clean Energy and Digital Technology

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## 1. Introduction: Diversifying Toward a Clean, Digital, and Productive Economy

### 1.1 Economic Diversification: The Imperative for a New Growth Model

Qatar’s vision to transform into a diversified, knowledge-based economy by 2030 hinges on a strategic pivot from its legacy concentrations in oil & gas and finance into high-productivity emerging domains, principally clean energy and advanced digital technologies. This transition is not merely about sectoral diversification but about fundamentally enhancing the nation’s economic complexity and productivity to ensure long-term prosperity. Qatar’s high dependence on hydrocarbons makes it vulnerable to volatile global energy prices and necessitates a transition to a more sustainable economic model (Al-Sulaiti et al. 2024).

Launched in 2008, the Qatar National Vision 2030 (QNV 2030) sets the long-term direction for human, social, economic, and environmental development through its four pillars. It remains the foundational reference for any workforce nationalization (Qatarization) policy that seeks to nurture nationals in new, niche areas (General Secretariat for Development Planning (GSDP) 2008; Government Communications Office (GCO) n.d.; International Media Office (IMO) n.d.). The vision aims to transform Qatar into an advanced society capable of sustainable development by fostering a diversified and competitive economy (United Nations Department of Economic and Social Affairs (UNDESA) n.d.). This involves a gradual reduction in its dependence on hydrocarbon industries while elevating the role of the private sector (Al-Sulaiti et al. 2024). The overarching

goal is to balance modernization with the preservation of traditions, manage economic growth, and ensure the well-being of current and future generations (GSDP 2008; IMO n.d.).

Achieving the goals of QNV 2030 requires overcoming significant challenges. The transition to a knowledge-based economy necessitates substantial reforms in education and training to cultivate a skilled workforce that can drive innovation (Mohamed and Koc 2017). Furthermore, it requires the development of a robust institutional framework that can effectively support a diversified economy (Nacheff, Jantan, and Boularas 2014). A key challenge lies in shifting from a public sector-led growth model to one driven by a vibrant private sector (Bi and Miyajima 2024). This requires creating a business environment that is attractive to both domestic and foreign investment (GCO n.d.). While Qatar has made strides in improving business efficiency and attracting foreign direct investment, areas such as labor market reforms and fostering a more competitive environment for businesses require further attention (Bi and Miyajima 2024; Al-Qahtani and Shirazi 2023).

The journey toward economic diversification is a long-term endeavor that demands sustained effort and strategic planning. While Qatar has made significant investments in education, research, and infrastructure, the transition to a knowledge-based economy is still a work in progress (Mohamed and Koc 2017). Successfully navigating this transition will require a concerted effort from all stakeholders, including the government, the private sector, and the academic community (Al-Sulaiti et al. 2024).

## 1.2 Strategic Enablers: The Rise of Digital and Clean Energy Sectors

Recent national strategies have sharpened the path toward economic diversification laid out in the Qatar National Vision 2030 (QNV 2030). The vision's economic development pillar explicitly calls for the responsible exploitation of hydrocarbon resources while simultaneously building a diversified, knowledge-based economy characterized by innovation and entrepreneurship (GSDP 2008).

The Third Qatar National Development Strategy (QNDS3, 2024-2030) and the National Digital Agenda 2030 (DA2030) translate this vision into concrete action, emphasizing digitization, innovation, and sustainability as the core engines of future growth (Council of Ministers Secretariat General n.d.; Ministry of Communications and Information Technology (MCIT) n.d.). QNDS3 is particularly ambitious, aiming to accelerate economic growth to an average of 4% per year, driven by expanded gas production and economic diversification (Council of Ministers Secretariat General n.d.; GCO 2024). It also targets a 2% average yearly increase in labor productivity to create high-skilled jobs and support higher wages (PSA 2024). These strategies explicitly connect the adoption of cloud computing, Artificial Intelligence (AI), and cybersecurity to national productivity gains and the creation of a more competitive and skills-rich labor force (MCIT 2024a; 2024b).

Critical enablers for this digital transformation are arriving at pace. Microsoft launched its Qatar cloud datacenter region in 2022, partnering with the Ministry of Communications and Information Technology (MCIT) on a National Skilling Program to train 50,000 people by 2025 (MCIT 2022; Microsoft News Center 2022). This initiative is part of a broader effort to accelerate digital transformation by enhancing the digital skills of the workforce. Google Cloud followed, opening its Doha region in May 2023, with a projected \$18.9 billion cumulative economic uplift and the creation of 25,000 jobs by 2030 (Kosta and Amin 2023; SAMENA Telecommunications Council

2023). These hyperscale platforms both expand the domestic digital market and create localized demand for roles in cloud architecture, AI, cybersecurity, data engineering, and sustainability. These developments are central to the Digital Agenda 2030's goal of establishing a leading digital economy powered by an attractive business environment and high-yield digital investments (MCIT n.d.-b).

In parallel, clean-energy assets have scaled rapidly, directly supporting the environmental development pillar of QNV 2030, which seeks a balance between development needs and environmental protection. The Al Kharsaah 800 MW solar PV plant, Qatar's first utility-scale solar project, was inaugurated in October 2022 and has already surpassed one million megawatt-hours of cumulative power production (Qatar News Agency (QNA) 2022; Power Technology 2023; QatarEnergy 2024b; TotalEnergies, n.d.). This project is a cornerstone of a broader strategy to increase renewable energy capacity to 5 GW by 2035 (Al-Mohannadi and Edwards 2025; The Peninsula 2024). Furthermore, Qatar is pursuing a robust Carbon Capture and Storage (CCS) program as a key component of its decarbonization roadmap. QatarEnergy is targeting the capture of over 11 million tonnes of CO<sub>2</sub> per year by 2035 through initiatives integrated with its LNG facilities and new downstream projects like a blue-ammonia plant (QatarEnergy 2024a; Wright 2022; John 2022). New local manufacturing footprints are also emerging, such as the Yutong and Mowasalat e-bus assembly plant, which broke ground in late 2022 and aims to support the full electrification of public transport (Alingal 2024; Mowasalat 2024).

### 1.3 The Core Policy Question: Aligning Qatarization with Future Economic Demands

The convergence of these digital and clean energy shifts creates entire new occupational families: from PV performance engineers and data-driven O&M analysts to battery, power-systems, and hydrogen safety specialists (Arcelay et al. 2021; Marangis et al. 2024). This global trend raises a core question for Qatar's economic strategy: How can Qatarization evolve, by using targeted policies, programs, and incentives, to rapidly and credibly develop national talent for these niche, high-skill domains while aligning with QNV 2030's sustainability pillars?

International evidence confirms that the transition toward a low-carbon economy, coupled with digitalization, is poised for modest net job creation globally. However, this positive outcome is not automatic and hinges on effective policy measures to manage significant workforce displacement and skills mismatches (Hanna, Heptonstall, and Gross 2024; International Labour Organization (ILO) 2024b). The new roles emerging from "Industry 4.0" are transforming the renewable energy sector, demanding a sophisticated blend of digital, technical, and transversal competencies (Arcelay et al. 2021). Successfully navigating this transition requires a proactive and strategic approach to human capital development.

The new occupations demand a hybrid skillset that merges domain-specific knowledge with advanced digital literacy. Key skill clusters include:

- **Digital and Data Skills:** Competence in Artificial Intelligence (AI), Big Data analytics, the Internet of Things (IoT), and cybersecurity is essential for optimizing renewable energy assets, enabling predictive maintenance, and managing smart grids (Arcelay et al. 2021).

- **Specialized Technical Skills:** Expertise is needed in areas like desert-climate PV performance analytics, Carbon Capture and Storage (CCS) project engineering, and green hydrogen systems (Arcelay et al. 2021).
- **Transversal and Cognitive Skills:** The dynamic nature of these sectors requires a workforce with strong problem-solving, critical thinking, adaptability, and interdisciplinary collaboration skills (Arcelay et al. 2021; OECD 2023c).

Addressing this multifaceted skills demand presents a significant policy challenge. Studies show that education and training systems often lag behind the rapid evolution of these new sectors, resulting in fragmented, ad-hoc, and inadequate learning pathways from education to employment (Presha and Victoria 2025). Closing this “skills gap” requires a long-term strategy focused on upskilling and reskilling the workforce through deliberate, coordinated initiatives between government, industry, and academia (Arcelay et al. 2021; IRENA and ILO 2024). This strategic alignment is a central component of ensuring a “just transition” that creates durable, high-value careers and distributes the economic benefits equitably (ILO 2024b). Answering this core policy question is therefore fundamental to achieving the economic diversification and productivity goals of QNV 2030 and QNDS3. This focus on human capital is a recognized component of Qatar’s national strategies; for instance, the National Climate Change Action Plan identifies the development of “environmental education and human capital” as a key enabler for successful implementation (Ministry of Environment and Climate Change (MECC) 2021). The subsequent sections of this report bridge this strategic ambition with on-the-ground policy by analyzing the specific gaps in Qatar’s emerging-sector skills landscape and proposing concrete pathways to build the required national talent.

## 2. Challenges to Qatarization: Identifying Gaps and Constraints in Emerging-Sector Skills

This section analyzes the primary obstacles to developing a national workforce capable of leading Qatar’s new emerging sectors. It begins by identifying the specific structural skill gaps in high-demand fields such as AI, cybersecurity, clean energy, and sustainable finance. Subsequently, it examines the critical discontinuities in the talent pipeline that prevent skilled individuals from entering the workforce. Finally, the section assesses the broader challenges of policy coordination and incentive alignment that hinder effective talent development.

### 2.1 Identifying Structural Skill Gaps: An Analysis of High-Demand Roles

The rapid pace of technological adoption and the strategic pivot toward a knowledge-based economy have created a foundational challenge: a mismatch between the current workforce’s skills and the specialized competencies demanded by new industries. This structural gap is not uniform but manifests distinctly across Qatar’s most critical emerging sectors. See Table 1 for a sector-by-sector summary of roles, drivers, and literature.

**Table. 1 Summary of High-Demand Roles and Skill Gaps in Emerging Sectors**

Emerging Sector	High-Demand Roles (The Gap)	Key Driver of Demand	Supporting Literature
<b>AI &amp; Data</b>	MLOps Engineers; Arabic NLP Practitioners	National AI Strategy / Data Access	1; 44; 67; 116; 142; 156
<b>Cybersecurity</b>	OT Security Specialists; AI Model Auditors	National Cybersecurity Strategy 2024–2030	83; 84; 98; 99; 125
<b>Clean Energy Systems</b>	PV Performance Analysts; CCS Engineers	Solar Build-out / CCS & Hydrogen Projects	9; 43; 59; 153; 165
<b>Sustainable Finance</b>	ESG Risk Analysts; Carbon Accountants	QCB Sustainable Finance Framework (2025)	29; 57; 64; 119; 120; 123

### 2.1.1 AI & Data

While Qatar possesses global-standard research assets like QCRI's Arabic Language Technologies group, a bottleneck exists in translating this research into scaled, production-grade products. There are notable shortages in specialized roles such as MLOps engineers, cloud data engineers, AI security specialists, and advanced Arabic NLP practitioners.

This challenge is particularly acute given that Qatar's national AI strategy explicitly focuses on leveraging data and AI for economic diversification, with a stated ambition to become a world leader in the field by 2030 (Hanafi, Kshetri, and Sharma 2021). The strategy identifies "data access" as a paramount pillar, aiming to build a robust data infrastructure and create a data-sharing program with standardized, AI-ready data (Albous, Al-Jayyousi, and Stephens 2025; Qatar Center for Artificial Intelligence (QCAI) 2019). However, the ambition is met with significant talent constraints. A recent analysis highlights that while GCC countries perform well in ambition, key capability gaps exist in skills, investment, and research, with talent remaining a primary constraint. Despite national skilling programs, Qatar has not yet built a sustainable, scaled AI talent ecosystem (Awad et al. 2025).

The shortage extends beyond general AI talent to specific, high-demand niches. The need for cloud data engineers is amplified by the fact that cloud infrastructure is the essential backbone for a modern AI ecosystem, facilitating the storage, processing, and analysis of vast datasets (Gelvanovska-Garcia, Rossotto, and Mačiulė 2024). This is critical as 70% of generative AI startups globally depend on such cloud infrastructure, and Qatar has prioritized the expansion of its high-performance computing (HPC) and data center capacity (Yuan 2025).

Furthermore, the scarcity of advanced Arabic NLP practitioners is a crucial gap. Qatar has a strategic focus on developing Arabic-centric AI as a matter of national and cultural identity (ESCWA 2025; QCAI 2019). This is exemplified by QCRI's development of advanced models and benchmarking tools like LArabench, which evaluates large language models for Arabic NLP and speech processing tasks (Abdelali et al., 2024). However, the very existence of such advanced research highlights the gap between academic leadership and the limited pool of practitioners available to commercialize these technologies or apply them at scale across the economy. This

regional challenge is compounded by a severe shortage of digital skills in areas like statistical analysis, data mining, and algorithm design (Hanafi, Kshetri, and Sharma 2021). Successfully transforming research leadership into production-grade applications requires a deliberate focus on cultivating these specialized skill sets to meet the demands of a data-driven economy.

## 2.1.2 Cybersecurity

With the codification of the National Cybersecurity Strategy 2024-2030 and the National Cyber Security Agency's (NCSA) AI security guidelines, demand is escalating for operational roles like red/blue teamers, OT (Operational Technology) security specialists for the energy sector, and AI model security auditors (NCSA 2024a; 2024b). This demand surge occurs amidst a significant global cybersecurity workforce gap, which was estimated at 3.4 million professionals in 2022 (NCSA 2024b). The supply of qualified nationals remains thin relative to the rapid adoption of hyperscaler cloud services and specialized technologies in critical sectors. Key areas with notable skill shortages include:

- **Operational Technology (OT) Security:** The increasing convergence of Information Technology (IT) and OT systems within Qatar's critical national infrastructure, particularly the energy sector, has created a pressing need for specialized OT security professionals. Unlike traditional IT environments where confidentiality is the priority, OT systems prioritize the availability, safety, and resilience of physical processes and industrial control systems (ICS) (Roshanaei 2021). Job market analysis shows that OT cybersecurity roles are typically not entry-level, requiring an average of nearly eight years of prior professional experience and specialized knowledge of standards like IEC 62443 (Ramezan, Coffy, and Lemons 2023). This high barrier to entry makes it difficult to quickly develop a local talent pipeline capable of defending against threats to critical infrastructure.
- **AI Security and Audit:** The national push towards a knowledge-based economy involves the broad adoption of AI. However, these systems introduce unique risks such as data poisoning, model extraction, and privacy violations that require specialized oversight (NCSA 2024a). The NCSA's guidelines call for AI systems to be robust, safe, fair, and transparent, creating a need for AI model security auditors who can assess these complex systems for vulnerabilities and ethical compliance (MCIT 2024c). These skills are distinct from traditional cybersecurity and are currently scarce.
- **Cloud Security:** While the adoption of hyperscale cloud services provides access to advanced security tools, it also introduces the complexity of a "shared responsibility model" (Qiang and De Salins 2025). Under this model, the cloud provider secures the cloud infrastructure, but the client organization is responsible for securing what is *in* the cloud, including data access controls, network configurations, and application security. This creates a strong demand for professionals with skills in cloud security architecture and governance to manage these responsibilities, a skill set that is in short supply.

## 2.1.3 Clean Energy Systems

A pressing need exists for expertise in desert-climate PV performance analytics, anti-soiling robotics, advanced grid integration, energy storage solutions, green hydrogen feasibility studies, and CCS project engineering. The challenge of localizing these roles is amplified by Qatar's unique environmental and industrial context. For example, the severe soiling effect in the MENA

region, where dust can reduce PV efficiency by up to 50% in a few months (Shenouda, Abd-Elhady, and Kandil 2022), creates a critical and highly specialized demand for technicians and engineers. These professionals must go beyond standard deployment and be skilled in performance analytics specific to desert conditions to accurately model and mitigate significant power losses (Sepúlveda-Oviedo 2025). This environmental reality directly fuels a skills gap in anti-soiling robotics, requiring specialists who can develop next-generation coatings and robotics to prevent long-term abrasion of panel surfaces, a key research area for QEERI (Hamad Bin Khalifa University (HBKU) n.d.; SOLAR MAG 2022). Similarly, integrating large-scale solar assets like the Al Kharsaah plant into the national grid creates a deficit in local expertise for managing intermittency and ensuring stability (Cavus 2025; Saleh, Hilal, and Haggag 2022).

Furthermore, as Qatar aims to leverage its natural gas reserves for a transition towards a hydrogen economy, there is a pronounced scarcity of talent for green hydrogen feasibility studies and CCS project engineering. These fields require a multidisciplinary skill set to address challenges ranging from the high cost of electrolysis and water scarcity to the complex engineering of large-scale carbon capture facilities (Khan and Al-Ghamdi 2023; Eljack and Kazi 2021; Mohammed et al., 2024).

While local RDI, exemplified by the QEERI Solar Consortium (HBKU n.d.), is strong, the pool of talent for large-scale deployment and operations is still nascent. This gap between advanced research and the available operational workforce represents a significant constraint on Qatar's clean energy ambitions.

#### 2.1.4 Sustainable Finance & ESG Analytics

The rapid codification of Qatar's sustainable finance ambitions is creating a structural skills gap that is particularly difficult to fill locally because it demands a novel, hybrid skillset. The Qatar Central Bank's (QCB) Sustainable Finance Framework, scheduled for implementation in 2025, will compel financial institutions to staff newly created roles focused on ESG risk, climate stress testing, and sustainability reporting (QCB 2025b). This regulatory push, explicitly tying national financial development to "Talent & Capabilities," acknowledges that the critical need is for professionals who combine traditional financial acumen with new expertise in sustainability (QCB 2023b; 2024a).

This challenge is not unique to Qatar but is a systemic issue across the Gulf, with analyses consistently highlighting a "scarcity of local sustainability skills and expertise" and a significant "talent gap" as primary constraints on the growth of green finance (Aboudouh 2025; Aparna and Ramakrishnan 2024). The regional need for "capacity building" is a foundational pillar of proposed frameworks, signaling a recognized, widespread shortage of qualified professionals (PwC 2025). For Qatar specifically, a lag in corporate governance and social performance disclosures compared to regional peers suggests a particular deficit in expertise related to non-financial reporting and corporate transparency, making the regulatory transition even more acute (ElAlfy et al. 2025).

Globally, this transition is creating new "ESG roles" and specialized "Risk analysts" that require the same blend of digital and sustainability-focused competencies (Srivastava et al. 2024). These new green jobs are often associated with a significant wage premium, particularly for women, which indicates that the labor supply is not meeting the rapidly growing demand from firms (Alexander et al. 2024). This supply-demand mismatch underscores a critical gap in education

and training pipelines (ILO 2024a). Without a sufficient pool of local talent in areas like carbon accounting, energy auditing, and ESG analytics, Qatar's financial institutions will face significant challenges in meeting the new regulatory mandates and capitalizing on the economic opportunities of sustainable finance.

## 2.2 Talent Pipeline Challenges: The Gap Between Certification and Employment

A robust talent pipeline is critical for sustained economic diversification, yet Qatar faces significant discontinuities that challenge the development of a national workforce capable of leading new emerging sectors. These challenges are present in both the creation of new high-skilled graduates and in the conversion of mass skilling initiatives into high-value employment.

The most acute challenge is the planned closure of Texas A&M University at Qatar (TAMUQ) by 31 August 2028. This decision removes a cornerstone of Qatar's advanced engineering talent pipeline that has been in place for over two decades (TAMUQ 2024a). Since its establishment in 2003, TAMUQ has been a critical institution explicitly tasked with supporting Qatar's National Vision 2030 by preparing highly skilled engineers to sustain industrial and economic growth (Elbashir and Parsaei 2015). The university has been a primary local source of graduates in disciplines essential to the national economy, having graduated over 1,500 students (Elbashir and Parsaei 2015; McGee 2024). Its closure creates an immediate and substantial gap in the supply of domestically educated, high-skilled engineering talent. This situation heightens the immediate reliance on alternative pathways, such as the government's established overseas scholarship programs, which must now be strategically leveraged to fill the specific, high-skill gaps created by TAMUQ's departure (Ministry of Education and Higher Education (MOEHE) n.d.-a; n.d.-b).

Furthermore, while mass-skilling initiatives are essential for broad-based digital literacy, converting short-term certifications into sustained, high-value employment is not automatic. The Qatari government, through the Ministry of Communications and Information Technology (MCIT), has actively sought to address this. The National Skilling Program, launched in collaboration with Microsoft, aims to train 50,000 people by 2025 and is a clear effort to build a digitally competent workforce and establish a talent hub (MCIT 2022). Recognizing the need for a structured approach, MCIT also launched the Digital Skills Framework to create standardized, nationally recognized qualifications for ICT skills, ensuring that training outcomes are aligned with the actual needs of the digital economy (MCIT 2025).

Despite these strategic efforts, international case studies, while not directly comparable, offer valuable lessons on the challenges of converting mass skilling to employment. For instance, a study on a national-level Coursera program in Costa Rica provides a useful parallel; it found that even with curated, in-demand courses offered for free, completion rates were low (around 10%), and the program had no significant direct effect on subsequent employment or earnings (Novella, Rosas-Shady, and Freund 2024). The primary positive outcome was an increase in participants' enrollment in further formal education, suggesting such programs often act as a gateway to traditional degrees rather than a direct pathway to employment (Novella, Rosas-Shady, and Freund 2024). This underscores a critical pipeline challenge for Qatar: bridging the gap between mass certification and verifiable, in-demand competencies that lead directly to high-value roles. For micro-credentials to succeed, they must serve as a potent and credible signal of marketable

human capital to employers, which is particularly crucial for workers who need to differentiate themselves (Baird, Bozick, and Zaber 2022).

This underscores a critical pipeline challenge: bridging the gap between mass certification and verifiable, in-demand competencies that lead directly to high-value roles in Qatar's emerging sectors. The success of initiatives like the National Skilling Program will depend on successfully embedding its certifications within the new Digital Skills Framework, thereby creating clear, credible pathways from training to employment that are recognized and valued by industry.

## **2.3 Systemic Barriers: Misalignment in Policy Coordination and Incentives**

Qatar has established world-class strategic frameworks (DA2030, QNDS3), robust legislation, and a modern regulatory environment. However, a gap exists between these high-level policies and their practical implementation (MCIT 2024a; GSDP 2008). Specifically, requirements for national skills development are not consistently written into the powerful contracts that drive the market, such as government procurement and Public-Private Partnership (PPP) agreements. This lack of specific requirements creates ambiguity for training institutions and job seekers, weakening the market's incentive to develop talent in these new, critical sectors.

The nation's PPP framework is a prime example. Law No. (12) of 2020 provides a strong legal basis for partnerships on major infrastructure and public service projects (Al-Sulaiti, Cid, and Ntai 2025; State of Qatar 2020). The official Public Private Partnerships Guidebook further details the process (Ministry of Commerce and Industry (MOCI) 2025). However, the crucial step of translating broad national goals into specific, mandatory skills-development clauses within these large-scale contracts is not yet systematic. International experience shows that without such explicit requirements, major projects often miss the opportunity to build a skilled local workforce, a finding noted in the US context (Lambart and White 2019; OECD 2025). While Qatar's PPP framework allows for these obligations, making them a standard and required component of contracts is essential to creating consistent, market-wide demand for national talent.

In contrast, targeted regulations in the financial sector demonstrate how effective this approach can be. The Qatar Central Bank (QCB) has proactively shaped a modern regulatory landscape with its FinTech Strategy and specific guidelines for Distributed Ledger Technology (DLT) and Data Handling (QCB 2025a; 2024b; 2023a). These regulations effectively compel financial institutions to hire professionals with specialized expertise in blockchain, data privacy, and financial technology. This success, however, highlights a fragmented approach. The clear demand signals created by the financial regulator have not been systematically replicated across the government's broader procurement and contracting activities.

This links directly to the global "skills-first" trend, where employers prioritize demonstrated skills over traditional qualifications (OECD 2025). For such a system to succeed, the government must clearly signal which skills are in high demand. While Qatar's national strategies embrace this goal, the critical next step is to embed these signals into the binding contracts and tenders that shape the market. Doing so will ensure that major national projects function not only as infrastructure developments but also as powerful engines for building the country's human capital.

### 3. Evolving Qatarization: A Policy Playbook for Niche Domains

To address the challenges identified in the previous section, this chapter presents a consolidated policy playbook designed to accelerate national participation in clean energy and digital technology. The proposed framework is structured around three core pillars: (1) building a robust talent supply through targeted skilling pathways, (2) creating sustainable market demand by embedding skills obligations in procurement and regulation, and (3) strengthening the ecosystem by bridging academia with industry and creating powerful incentives for national talent. The framework is summarized in Table 2.

**Table. 2 A Three-Pillar Policy Framework for Talent Development**

Pillar	Key Initiatives / Mechanisms	Supporting Literature
<b>Building Talent Supply</b>	National Micro-Credentials; AI Safety Academy; Clean Energy Field Engineer Track	23; 44; 126; 134; 146
<b>Creating Market Demand</b>	Embed Skills in Procurement (PPP Clauses); Regulator-Driven Talent Signals	61; 80; 93; 114
<b>Bridging Academia &amp; Industry</b>	Co-funded Industry PhDs; Sectoral Incubators & Testbeds; Diaspora & Expert-in-Residence	3; 69; 73; 82; 139; 163

#### 3.1 Building Talent Supply: Targeted Skilling Pathways for High-Demand Roles

Addressing the skills deficit requires a fundamental shift away from traditional, long-cycle education toward more agile and targeted pathways that are directly aligned with industry needs. The following initiatives are designed to build a robust national talent supply by offering practical, certified competencies that lead directly to high-value employment.

##### 3.1.1 National Micro-Credentials Aligned to Hyperscaler Stacks

Following the precedent set by leading digital economies like Singapore (Infocomm Media Development Authority (IMDA) 2025; 2022), Qatar must establish an official, DA2030-endorsed catalogue of micro-credentials. This policy directly confronts the most significant challenge facing enterprises today: a critical skills gap in the AI-driven economy, where a majority of leaders are now unwilling to hire talent that lacks AI skills (Johnson 2025). By leveraging micro-credentials, a globally recognized tool for mapping skills to high-demand digital roles (Gamage and Dehideniya 2025; McGreal et al. 2022), this approach not only builds a job-ready workforce but also serves as a core component of ensuring a ‘just transition’ for the MENA region (ILO 2024c; Gazzo et al. 2024).

To ensure immediate market relevance, this catalogue must be built in direct alignment with the technology stacks of hyperscale cloud providers like Microsoft and Google, as these platforms are the bedrock of the new economy. This approach is validated by research showing that combining degrees with targeted, industry-recognized certifications significantly enhances employability (Kovalev, Stefanac, and Rizou 2025). However, creating a catalogue is not enough. To overcome employer uncertainty, a key barrier to adoption, these credentials require strong government endorsement to signal quality and build trust (Ha, Van Dyke, and Spittle 2025). Finally, to close the loop from training to career, these certified micro-credentials must be explicitly linked to reserved internship slots in state-owned enterprises like QatarEnergy and other regulated sectors. This vital connection transforms a certificate into a tangible career opportunity and creates a clear, high-value pathway from skilling to employment (World Bank 2016).

### 3.1.2 AI Safety & Security Academy

As Qatar accelerates its adoption of AI, it exposes its critical energy, finance, and government sectors to a new class of security risks. The global cybersecurity workforce already faces a significant talent deficit, a challenge compounded by the sophistication of AI-specific threats like data poisoning and model extraction (Dkaidek and Rashid 2024; Oladimeji, Egon, and Brooklyn 2024; OECD 2023b). To address this vulnerability, this policy proposes establishing a cross-ministry AI Safety & Security Academy, operationalizing the National Cyber Security Agency's (NCSA) AI security guidelines (NCSA 2024a), creating a national pipeline of certified professionals in high-demand, niche roles like AI security assessors, model risk managers, and AI red-teamers.

The academy's mission would be to cultivate certified professionals in niche, high-demand roles such as AI security assessors, model risk managers, and AI red-teamers. This parallels the emergence of new accountability professions, such as the independent AI auditors now required in other jurisdictions (Groves et al. 2024). For the academy's graduates to be effective, their training must be intensely practical, as international research confirms that hands-on, simulation-based methods are most effective for complex cyber roles (Prümmer, Van Steen, and Van Den Berg 2023). A core feature should be the use of regulated cloud sandboxes. This is a global best practice for building national cyber resilience by allowing for the safe testing of emerging technologies (Qiang and De Salins 2025; Appaya, Gradstein, and Haji Kanz 2020). By providing trainees with experience in these sandboxes, the academy can ensure its graduates are job-ready, equipped with the practical skills needed to secure Qatar's AI ecosystem and build national cyber resilience.

### 3.1.3 Clean Energy Field Engineer Track

Qatar's strategic pivot to clean energy, marked by major investments in solar, Carbon Capture and Storage (CCS), and hydrogen, creates a significant diversification and employment opportunity. The energy transition is projected to generate hundreds of thousands of new roles across the GCC, the vast majority in solar (Sanfilippo, Vermeersch, and Benito 2024). Yet it confronts a global and regional skills mismatch between new technical requirements and existing workforce capabilities (Greenspon and Raimi 2024).

This challenge is particularly acute in the GCC, where economies face a structural "shortage of skilled workers" and where youth show low enrollment and interest in STEM fields (Bousrih, Elhaj, and Hassan 2022; Kayan-Fadlelmula et al. 2022). Demographic shifts intensify the issue as

experienced workers retire, requiring faster knowledge transfer to new entrants (Forrest et al. 2025).

To ensure Qataris can lead the nation's energy transition, a dedicated Clean Energy Field Engineer Track is recommended in partnership with QEERI, Kahramaa, and private developers. The track should bypass traditional academic pathways and deliver certified, hands-on modules such as "PV & Storage Performance" and "CCS Operations," reflecting best practices seen in other MENA countries (Groves et al. 2024). Graduation should be tied directly to deployment and apprenticeship opportunities at national-scale assets like the Al Kharsaah Solar Power Plant (ILO 2020). This link aligns training with operational needs and provides a clear, immediate career pathway, consistent with broader employee expectations; in a U.S.-based McKinsey survey, 48% of workers ranked training as the most important factor for AI adoption (Mayer et al. 2025).

### 3.1.4 Sustainable Finance & Climate Risk Certification

The implementation of the Qatar Central Bank's (QCB) Sustainable Finance Framework in 2025 is a powerful demand signal. It will create new, high-value roles for professionals with specialized skills in ESG risk, climate stress testing, and green lending (QCB 2025b). To ensure Qataris can fill these roles, a targeted skilling pathway is essential.

This local demand reflects a massive global shift. The International Energy Agency (IEA) projects that by 2025, investment in clean energy will be double that of fossil fuels (IEA 2025). Qatar's national strategy to mobilize at least \$75 billion for sustainable investments by 2030 is therefore not just a financial goal, but a workforce development imperative that requires a pipeline of skilled national talent (Invest Qatar 2022; QCB 2025b). These new roles demand a sophisticated understanding of how to identify, quantify, and manage complex climate-related financial risks, including physical and transition risks (Baudino and Svoronos 2021; Korzeb et al. 2024). The use of AI in financial modeling further elevates this need, requiring professionals who can manage system vulnerabilities responsibly (Financial Stability Board (FSB) 2024). This is a strategic priority, as banks with stronger ESG capabilities demonstrate greater resilience and higher asset quality (Cantero-Saiz, Polizzi, and Scannella 2024).

This global skills gap creates an opportunity for Qatar to build a competitive advantage through targeted human capital development, allowing its financial institutions to capitalize on the economic benefits of leading the transition to a sustainable economy (Financial Services Skills Commission 2024; ILO 2024c).

To meet this demand, this policy advocates for the co-design of QCB-aligned micro-credentials that are directly tied to the job roles emerging from the new regulatory landscape. By developing these certifications in partnership with the financial sector, their market relevance and value are assured (Varadarajan, Koh, and Daniel 2023). This initiative helps build a system of accountability where professionals, firms, and regulators have a shared understanding of required competencies (Laine, Minkkinen, and Mäntymäki 2024; Novelli, Taddeo, and Floridi 2024).

Linking these micro-credentials directly to new regulatory standards, a trend seen in broader AI governance frameworks like the EU AI Act (Van Kolfschooten and Van Oirschot 2024), will make them a tangible asset for career advancement and a clear metric for employers. This approach transforms regulatory change into a direct and credible pathway from training into high-value employment, fully aligning with the broader principles of responsible AI governance (Papagiannidis, Mikalef, and Conboy 2025).

## 3.2 Creating Market Demand: Embedding Skills Obligations in Procurement and Regulation

A core challenge in economic diversification is aligning the supply of skilled national talent with the emerging demands of new industries. While supply-side policies like education and training are crucial, they are most effective when complemented by strong, clear demand signals from the market. International experience demonstrates that government procurement and sector regulation are powerful levers to create this demand, shifting skills development from a peripheral corporate social responsibility activity into a core business requirement (OECD 2023a). This approach translates high-level national strategies into concrete, binding commercial obligations, ensuring that major national projects function not only as infrastructure developments but also as engines for building human capital (Jones 2022).

### 3.2.1 PPP Skills Clauses

In line with Qatar's PPP Law No. 12 of 2020, it is critical to mandate the inclusion of Skills Development Obligations (SDOs) in all major infrastructure PPPs (State of Qatar 2020). The nation's PPP framework provides a strong legal basis for such partnerships, and the official Public Private Partnerships Guidebook further details the process (MOCI 2025). However, international experience shows that without explicit, mandatory skills-development clauses within large-scale contracts, major projects often miss the opportunity to build a skilled local workforce (European Training Foundation (ETF) 2020; Jones 2022). Effective skills-focused partnerships require clear operational guidelines and shared responsibilities for training, infrastructure, and graduate placement pathways to succeed (ILO Country Office for Bangladesh 2018). While Qatar's PPP framework allows for these obligations, making them a standard and required component of contracts is essential to creating consistent, market-wide demand for national talent.

### 3.2.2 Regulator-Driven Talent Signals

Beyond procurement, targeted regulations in key sectors can create powerful, market-wide demand for specific skills. This approach aligns with the recognition of public procurement as a strategic instrument for achieving government policy goals (OECD 2023a). This requires regulated firms in finance and technology to file annual Qatari Talent Plans for priority roles and could tie incentives, such as those for data hosting, directly to the employment and training of certified nationals in cloud and cybersecurity roles. This approach aligns with a significant global trend towards making human capital a core component of corporate disclosure and regulatory oversight. For instance, the U.S. Securities and Exchange Commission (SEC) has modernized its disclosure rules to explicitly include human capital resources as a topic material to understanding a business, viewing it as an important driver of long-term value (SEC 2022). Similarly, the European Union's new European Sustainability Reporting Standards (ESRS) mandate detailed disclosure on a company's "Own Workforce" (ESRS S1), covering training and skills development, which compels companies to measure, manage, and report on their human capital strategies (OECD 2023a). By creating similar regulatory requirements, Qatar can ensure that talent development becomes a strategic priority for key firms, rather than an afterthought.

### 3.3 Bridging Academia and Industry: Scaling Applied Research Partnerships

A critical challenge in shifting to a knowledge-based economy lies in closing the gap between academic research leadership and the limited pool of practitioners available to commercialize or apply new technologies at scale (Hanafi, Kshetri, and Sharma 2021). Successfully transforming research into production-grade applications requires deliberate, structural bridges that connect academia and industry. These bridges facilitate the mobility of talent and ideas, ensuring that research is focused on real-world problems and that a pipeline of skilled nationals is developed to lead new sectors. Two powerful mechanisms for building this connectivity are co-funded advanced degrees with embedded residencies and the establishment of sectoral incubators and testbeds.

#### 3.3.1 Co-funded Industry PhDs and Professional Master's

A proven method for fostering knowledge transfer is through collaborative doctoral education programs that embed students within an industrial context (Kuntuu, Huttu, and Neuvo 2018). These programs, often called "industrial doctorates," are educational tools designed to build bridges between the academic and industrial sectors by having PhD candidates carry out research while being employed in a knowledge-based company (Roolaht 2015). This model creates what are known as "boundary spanners," who are doctoral students and graduates that can form a bridge between academia and industry by transferring new scientific competencies, fresh insights, and innovative mindsets directly into the industrial R&D domain (Kuntuu, Huttu, and Neuvo 2018; Kneale et al. 2024).

This embedded approach provides substantial benefits for all stakeholders. Industrial PhD students gain contextual understanding, tacit knowledge, and access to data and networks that are invaluable for their research and career development (Bernhard and Olsson 2023). For companies, these programs offer a direct channel to influence research, ensuring it addresses their real-world challenges, and provide access to a pipeline of highly skilled, industry-ready talent already familiar with the corporate environment (Compagnucci and Spigarelli 2024; Kuntuu, Huttu, and Neuvo 2018). For the national economy, this model accelerates the development of a high-skilled, specialized domestic workforce capable of translating advanced research into commercial value. Funding advanced degrees in AI, cyber, and energy systems that require embedded residencies in national companies or ministries ensures research is focused on solving tangible, real-world problems.

#### 3.3.2 Sectoral Incubators and Testbeds

Complementing human capital initiatives requires physical and regulatory infrastructure where innovation can be safely tested, validated, and prepared for market deployment. Sectoral incubators and testbeds provide this crucial environment, serving as shared platforms for applied research and commercialization (UNESCO 2015).

A prime example of this is the QEERI Solar Consortium, which functions as a "Desert Solar Lab." It brings together solar-related companies to conduct private equipment testing and collaborative research on solar technologies specifically for desert climates (QEERI n.d.). Its well-established Outdoor Test Facility provides the physical infrastructure to validate technologies against Qatar's unique environmental conditions.

Similarly, QCRI's National Cyber Security Research Lab (NCSRL) serves as a model for an "Arabic AI & Safety Lab" (QCRI n.d.). It comprises a Secure Data Lab for sensitive data analysis and, crucially, a National Cyber Range, a controlled computing environment for training, testing, and validating new cybersecurity technologies before deployment (QCRI n.d.). Such testbeds are vital for building national cyber resilience and developing a local talent pool.

In the digital economy, this concept extends to regulatory sandboxes. These are controlled, live-testing environments that allow firms to experiment with innovative fintech products under regulatory supervision (World Bank 2020; Zetzsche et al. 2017).

Aligning the Fintech Sandbox 2.0 with national priorities creates a direct talent pipeline by providing a space where new digital financial solutions can be tested and validated. Furthermore, these sandboxes and testbeds generate ideal problem sets for applied educational methods, such as the Problem-Based Learning (PBL) approach used in modern engineering education. This creates a virtuous cycle between industry, research, and talent development (Rodríguez González and Fernández Batanero 2016; Rodriguez - Sanchez et al. 2024).

### **3.4 Fostering National Talent: Incentivizing Critical Careers and Attracting the Diaspora**

Beyond creating skills and jobs, a successful Qatarization strategy must make careers in these emerging sectors both attractive and prestigious for nationals. Complementing the supply-side policies are powerful incentives designed to shape career choices, retain top talent within strategic industries, and harness the valuable expertise of the Qatari diaspora.

#### **3.4.1 "Critical Occupations" Incentive Package**

Leveraging the National Strategy for an Effective and Highly Productive Workforce 2024-2030 and the foundational Qatar National Occupational Classification (QNOC), Qatar should define and regularly update a dynamic list of critical occupations (MoL 2024b; 2024c). This targeted list should be backed by a calibrated incentive package, including wage top-ups and accelerated promotion bands. The QNOC provides the standardized framework necessary for this task, while the national strategy provides the policy impetus to boost productivity and increase Qatari participation in the private sector. Creating these clear, well-compensated career paths is a fundamental prerequisite for attracting and retaining the nation's top talent in strategic sectors (OECD 2004).

#### **3.4.2 Diaspora and Expert-in-Residence Programs**

Introduce a Qatar Technology Fellows program to place Qatari diaspora members and global experts within key companies and ministries to serve as mentors and coaches. Qatari professionals abroad are a vital and often untapped resource for national development. While not all expatriates may choose to return, surveys of the MENA diaspora show a strong desire to "give back" and remain engaged with their home country (Malouche, Plaza, and Salsac 2016). A fellowship program creates a formal pathway to harness this potential, targeting those motivated individuals who can translate global experience into local impact.

These returning experts bring more than just technical skills; they offer a unique understanding of how to adapt global best practices to the local context (Lam and Rui 2023). Placing them directly inside an organization as an "expert-in-residence" is a proven model for effective

knowledge transfer (Vindrola-Padros et al. 2017). This approach has been used successfully in other countries. For instance, Canada's Health System Impact (HSI) Fellowship places researchers inside health organizations to solve real-world problems (Kasaai et al. 2023), and Scotland's "Global Scot" network connects Scottish expatriates with businesses back home to provide mentorship and support (OECD 2004). A formal fellowship program in Qatar would provide a structured way for the motivated segment of the diaspora to contribute its valuable expertise, accelerating innovation and building a sustainable pool of local talent.

### 3.5 Regional Context: Benchmarking with GCC Peers

Qatar's strategic focus on niche, high-skill domains occurs within a highly competitive regional landscape. Both Saudi Arabia and the UAE have launched ambitious, large-scale initiatives to build their own knowledge-based economies. Saudi Arabia's "Saudi Vision 2030", for example, has driven massive investment in broad-based digital upskilling through programs like the Saudi Digital Academy (SDA) and partnerships with major tech firms to train its youth for roles in AI and cybersecurity (Saudi vision 2030 n.d.). Similarly, the UAE's "Projects of the 50" explicitly targets the development of a competitive knowledge economy, with a strong focus on attracting global talent and scaling general digital skills for Emiratis in fintech and renewable energy (The Official Portal of the UAE Government (U.ae) n.d.).

By comparing Qatar's targeted, high-skill approach to these broader national programs, this report's recommendations can be better positioned to create a unique and sustainable competitive advantage for Qatar in specialized domains. This strategic differentiation, focusing on depth over breadth, is designed to create a durable comparative advantage, positioning Qatar as an indispensable hub for niche expertise that larger-scale digital transformation initiatives may overlook.

## 4. From Policy to Action: Implementation Strategy and Risk Management

This section translates the policy initiatives detailed in Section 3 into a practical implementation strategy. It synthesizes the proposed programs into cohesive, sector-focused action plans for clean energy, cloud, AI, cybersecurity, and fintech. Crucially, it also outlines a framework for identifying and mitigating the key risks associated with the execution of this strategy, ensuring its long-term viability and success.

### 4.1 Sectoral Roadmaps: Integrated Action Plans for Implementation

An effective policy playbook requires a clear and actionable implementation strategy that is tailored to the unique dynamics of each priority sector. The following integrated plans translate the proposed policy levers into concrete initiatives for clean energy, digital technology, and finance, building upon Qatar's existing institutional strengths.

#### 4.1.1 Clean Energy & Sustainable Mobility

The durability of the clean-energy talent market is signaled by the Al Kharsaah plant, ongoing solar expansion, and the 11 Mt CO<sub>2</sub>/yr CCS by 2035 target (MECC 2021). The Yutong/Mowasalat e-bus assembly plant and its associated electrified depots create a new industrial skills base in

manufacturing, quality assurance, and battery safety (Mowasalat 2024). To translate strategy into action, the following key Qatarization levers are proposed, building on the foundations of existing national training frameworks:

- **Establish a PV Performance Academy** with mandatory site embeddings. This would be developed in partnership with entities like Qatar General Electricity & Water Corporation (Kahramaa), leveraging its existing field training opportunities for students (Kahramaa n.d.).
- **Create a national CCS Operations Cohort**, led by key energy sector players like QatarEnergy in collaboration with universities and international partners. This initiative would leverage and expand upon existing structures like the QatarEnergy LNG Internship Program, which already provides students with practical work experience (QatarEnergy LNG n.d.).
- **Develop an E-bus Manufacturing & Maintenance Pathway** aligned with TVET institutions to create a talent pipeline for the growing sustainable transport sector.

#### 4.1.2 Cloud, AI & Cybersecurity

The domestic cloud market is underpinned by the presence of Microsoft and Google hyperscaler regions and reinforced by new regulatory guardrails. To operationalize the goals of the National Cyber Security Strategy 2024-2030 (NCSA 2024b), the following strategic initiatives are proposed:

- **Launch a Cloud-to-Career Program** with reserved graduate roles for certified nationals. This initiative would be scaled through established public-private partnerships like Qatar's Digital Center of Excellence, a collaboration between MCIT, Microsoft, and TeKnowledge, which is already focused on building a skilled digital workforce (TeKnowledge n.d.). Such partnerships are an internationally recognized best practice for delivering skilling at scale (Microsoft Public Sector Center of Expertise n.d.).
- **Create AI Safety Fellowships** for auditing AI models in public services. This program would directly implement the *Principles and Guidelines for Ethical Use of Artificial Intelligence* issued by MCIT (MCIT 2024c). These fellowships would cultivate a specialized talent pipeline capable of addressing sophisticated, AI-specific threats like data and/or model poisoning and model extraction (Rigaki and Garcia 2023; Goupil et al. 2022).

#### 4.1.3 Fintech & Digital Economy

Demand in this sector is being catalyzed by the Qatar Central Bank's (QCB) proactive regulatory frameworks, including its Fintech Strategy (QCB 2023a) and Sustainable Finance Framework (QCB 2025b). The QCB's FinTech Supervision Department is already tasked with fostering innovation in the market (QCB n.d.). It is proposed that Qatarization be advanced through two targeted programs:

- **Implement a RegTech Residency program** for graduates to rotate through banks. This initiative would be modeled on the internationally proven concept of "regulatory sandboxes," which allow firms to experiment with new fintech products under regulatory supervision, creating a direct talent pipeline in the process (Alaassar, Mention, and Aas 2021).

- **Establish a proposed Green Finance Guild**, modeled on professional development bodies, to upskill analysts in climate risk, an initiative that would be directly aligned with the mandates of QCB's upcoming 2025 circular.

## 4.2 Proactive Governance: Risk Assessment and Mitigation Strategies

Any ambitious national strategy is accompanied by inherent risks that, if left unaddressed, can undermine its success. Proactive governance and a clear-eyed assessment of potential challenges are therefore essential for ensuring the long-term viability and impact of the proposed Qatarization framework. Key risks and responses appear in Table 3.

**Table. 3 Risk and Mitigation Matrix for Qatarization Strategy**

Identified Risk	Proposed Mitigation Strategy	Supporting Literature
<b>Academic Pipeline Risk</b>	Establish MOUs with global universities; scale KTPs; co-taught industry master's with HBKU/QEERI	4; 44; 47; 134
<b>Credential-Job Mismatch</b>	Tie procurement scoring to hiring; accelerate QNOC-to-ESCO mapping; reserve placements	8; 36; 83; 92; 93; 103
<b>Over-reliance on Expatriates</b>	Use SDOs + critical-occupation incentives; launch diaspora fellowships; adopt GSP models	92; 93; 163; 167;
<b>Cyber &amp; AI Safety Risk</b>	Scale NCSA-aligned training; mandate model risk governance across public services	26; 98; 99; 105; 108; 117

### 4.2.1 Academic Pipeline Risk

The TAMUQ closure heightens the need for alternative engineering pipelines.

- **Mitigation:** Immediately establish scholarship MOUs with top-tier global universities and launch co-taught industry master's programs with HBKU/QEERI. To be successful, these new partnerships must consider key factors such as institutional strategy alignment, host country regulatory understanding, and balanced governance models (Hickey and Davies 2022). Existing mechanisms like the QRDI Council's Knowledge Transfer Partnership (KTP) program, which facilitates collaboration between universities and businesses to transfer knowledge from academic experts to industry, should be scaled up (HBKU n.d.; QRDI Council 2025).

### 4.2.2 Credential-Job Mismatch

Certifications may not convert to employment without clear demand signals. International experience shows that complex, incentive-based systems for skills planning often fail to produce useful data or secure employer engagement, leading to a mismatch (Allais and Ngwangu 2025).

- **Mitigation:** Directly tie public procurement scoring and contract milestones to the absorption of certified trainees. This creates a powerful, market-driven demand signal for

national talent, a key recommendation in overcoming skills gaps (PwC 2022). Furthermore, Qatar is already building the foundational infrastructure to solve this mismatch with the recent launch of the Qatar National Occupational Classification (QNOC) (MoL 2024c). This initiative aims to create a unified and comprehensive national reference for occupational data, which will serve as the cornerstone for a new Labour Market Information System (LMIS) designed to directly connect educational curricula with labor market needs (MoL 2024a). To ensure these national credentials are also recognized internationally by employers, the next logical step is to accelerate the mapping of QNOC to global frameworks like the European Skills, Competencies, Qualifications and Occupations (ESCO) (NPC 2025).

#### **4.2.3 Over-reliance on Expatriates**

Failure to build national leadership can perpetuate dependency.

- **Mitigation:** Vigorously use SDOs, critical occupation incentives, and diaspora fellowships to accelerate the placement of nationals into leadership roles. A powerful approach would be to adopt Global Skill Partnership (GSP) models, which are bilateral agreements that link training in the origin country (Qatar) to the specific needs of employers, both domestically and internationally. This model helps mitigate “brain drain” by training more people than are needed for migration, thereby increasing the local skilled workforce (Acosta et al. 2025). Programs like the QSTP Fellowship, which place researchers and experts within the local ecosystem, can serve as a foundation for this model (QSTP n.d.).

#### **4.2.4 Cyber & AI Safety Risk**

Rapid AI adoption without skilled national oversight creates systemic risk. This is particularly acute as AI systems introduce unique risks such as data poisoning, model extraction, and privacy violations that require specialized oversight (NCSA 2024a; Rigaki and Garcia 2023).

- **Mitigation:** Scale NCSA-aligned training and mandate model risk governance for all AI systems deployed in public services, in accordance with the national principles for ethical AI development and deployment (MCIT 2024c). This includes enforcing regulations such as the QCB’s Information and Cyber Security Regulation for Payment Service Providers, which already contains specific clauses for AI (QCB 2022).

## **5. Conclusion**

Aligning Qatar’s human capital development with the sustainability pillars of QNV 2030 provides a powerful, long-term vision. This requires creating structured and durable career ladders that lead from K-12 education to high-value careers in the new economy, building lasting communities of practice (Human Development). It means fostering local content in skills, ensuring that technological adoption translates into Qatari managerial and technical leadership (Economic Development). A workforce proficient in clean energy technologies is a direct enabler of the nation’s decarbonization goals (Environmental Development). Finally, increasing national participation in these frontier fields reinforces social cohesion and ensures that public digital services are embedded with local ethics, safety, and cultural nuances (Social Development).

## Key Takeaways:

- 1. A Strategic Imperative:** The evolution of Qatarization is not merely a labor market policy but a strategic imperative for achieving the economic diversification and productivity goals of QNV 2030 and QNDS3.
- 2. Dual-Sector Focus:** Success requires simultaneously developing talent pipelines for two critical, high-skill domains: clean energy (solar, CCS, sustainable transport) and digital technology (cloud, AI, cybersecurity).
- 3. From Education to Employment:** Closing the persistent skills gap requires moving beyond traditional education to integrated pathways, including industry-aligned micro-credentials, co-funded professional master's/PhDs, and reserved internship slots that lead directly to employment.
- 4. Demand-Side Policies are Crucial:** Policy must actively create market demand for national talent by embedding Skills Development Obligations (SDOs) in PPPs and government procurement, and using regulatory levers to incentivize the hiring of certified nationals. Supply-side skilling efforts will only succeed if they are met with clear, powerful, and consistent demand from the market.
- 5. Data-Driven Accountability and Phased Monitoring:** The strategy's success hinges on rigorous, transparent monitoring. A public-facing KPI dashboard, updated annually and aligned with NDS3 milestones, should be established to track metrics on certification, placement, retention, and wage growth in critical occupations. This ensures accountability and allows for agile policy adjustments based on measurable outcomes.
- 6. Risk Mitigation is Key:** Proactive measures are needed to mitigate significant risks identified in this report, such as the closure of TAMUQ, the potential for credential-to-job mismatch, and over-reliance on expatriate labor in leadership roles.

Taken together, these principles form a cohesive and actionable framework designed to transform Qatarization from a legacy labor market policy into a powerful engine for building the sustainable, knowledge-based economy envisioned in the Qatar National Vision 2030.

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