

Artificial Intelligence and Qatar’s Vision: Strategies, Achievements,
and National Impacts

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Abstract:

This study highlights the pivotal role of artificial intelligence in achieving "Qatar National Vision 2030" by analyzing the national strategies adopted by Qatar to promote the adoption of intelligent technologies as a driver of digital transformation and sustainable development. The article focuses on government strategies designed to build an advanced technological infrastructure through substantial investments in research and development, as well as international partnerships with leading innovation centers. It also explores local innovations in areas such as smart healthcare, adaptive education, energy management, and smart cities, highlighting flagship projects such as the "Qatar Center for Artificial Intelligence" and big data applications in the gas sector. The study underscores the tangible national impacts—both economic and social—from creating high-quality job opportunities to enhancing the country’s global competitiveness. Additionally, it discusses the necessity of developing human capital and ensuring cybersecurity, emphasizing that Qatar's model represents a unique integration of technological ambition and societal priorities. This positions the country as a key player in the global AI landscape while preserving its cultural identity and strategic autonomy.

Keywords: Artificial Intelligence; Qatar National Vision 2030 ; Qatari model of technological development; Flagship projects; Technology; society integration society; Digital transformation; Technological infrastructure.

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INTRODUCTION:

Humanity is currently living in an era of rapid technological advancement, and the progress of our civilization lies in our ability to embrace artificial intelligence as a science that enables machines to perform intelligent human tasks to solve complex problems.

The technological revolution has brought about a fundamental change in how we live, work, and interact with the world around us. At the heart of this transformation lies artificial intelligence, a rapidly evolving technology that is beginning to have a profound impact on the global economy.

As artificial intelligence matures, the world has witnessed a paradigm shift in how tasks and operations are carried out. Machines and algorithms are increasingly taking on roles that were previously exclusive to humans. The AI revolution is not an isolated phenomenon but an ongoing process characterized by the integration of intelligent systems into a wide range of applications. This integration is driven by several key factors, including advances in computing power, the development of sophisticated algorithms, the availability of vast amounts of data, and the relentless pursuit of innovation by researchers, entrepreneurs, and policymakers.

Artificial intelligence brings together multidisciplinary knowledge, including electronics (data collection and neural networks), computer science (data processing and deep learning), and mathematics (data analysis models), as well as humanities and social sciences to analyze the societal impact of these new technologies. AI applications are at the core of major industrial and social challenges.

AI will be essential in the coming years, as nations and companies have recognized its importance and are investing heavily in these technologies that promise to revolutionize our societies—ranging from automated and improved medical diagnostics to safer self-driving cars and significant productivity gains.

If countries miss the AI revolution, it will have far-reaching effects on all aspects of life in the future. Every nation now has the opportunity to take the lead and play a crucial role in the evolution of artificial intelligence.

As the digital revolution continues to reshape global societies, Qatar is making significant and rapid strides toward establishing itself in the field of artificial intelligence. The Ministry of Transport and Communications, in collaboration with Hamad Bin Khalifa University, has launched a pioneering effort by publishing Qatar's National AI Strategy.

This comprehensive strategy serves as a national roadmap for AI integration and development, aligning fully with Qatar National Vision 2030. The goal is not only to keep pace with technological advancements but also to ensure Qatar's competitive position in the global AI landscape.

Accordingly, this article aims to explore Qatar's AI strategy by presenting the theoretical and conceptual foundations of artificial intelligence, highlighting its key enablers, and enhancing the understanding of these advanced technologies and their potential as a force for the greater good of humanity.

Qatar has recognized the pivotal role of AI in shaping the 21st century and has implemented several strategies and initiatives that have led to the deployment of various AI applications across multiple service sectors. This has positioned Qatar as a leading beacon in the region's AI journey.

The central issue of this study revolves around understanding the concept and applications of artificial intelligence while identifying the key enablers, drivers, and requirements for AI implementation in Qatar. It also focuses on the efforts made in this field, including strategies, initiatives, and applications across various sectors.

To address this issue, the article seeks to answer the following main question:

What are the key features and foundational principles of Qatar's AI experience?

This overarching question leads to the following sub-questions:

What are the theoretical and cognitive frameworks of artificial intelligence?

What are the key enablers and pillars of artificial intelligence in Qatar?

What are the main pillars of Qatar's National AI Strategy (2024–2030)?

What is the impact of AI applications on the daily life of Qataris?

Artificial Intelligence – Concept and Applications:

1. The Conceptual Foundation of Artificial Intelligence:

The Oxford Dictionary defines artificial intelligence as the ability of a machine to perform tasks that require human intelligence, such as visual perception, speech recognition, decision-making, and language translation. According to the dictionary, AI has two main objectives. The first is technological, focusing on utilizing computers in ways that may differ from human cognitive processes to accomplish the same tasks. The second objective is scientific and philosophical, aiming to use AI concepts and models to help answer fundamental questions about humans and other living beings.¹

Artificial intelligence refers to a machine's ability to imitate human thought processes, such as reasoning and exploration. With significant advancements in computing, it has become evident that machines can perform more complex tasks than previously anticipated. AI systems can explore and prove intricate mathematical theorems, play chess with exceptional skill, and execute tasks at remarkable speed and precision while storing vast amounts of data. However, no AI program has yet matched the flexibility of the human mind, particularly in highly analytical and inferential tasks.²

AI encompasses a range of characteristics and behaviors exhibited by computer programs, enabling them to simulate human cognitive abilities and thought patterns. These capabilities include learning, reasoning, and responding to unprogrammed situations within a machine.³

2 Artificial Intelligence: A Historical Background:

Artificial intelligence is a branch of computer science that enables systems to learn and perform tasks typically associated with human intelligence, such as speech recognition, decision-making, and visual perception.

In the 1950s, achieving artificial intelligence seemed far from reality, as computers at that time were unable to store information or perform tasks without high costs. Between the 1950s and 1970s, the computing industry began to rely on faster and more economical machines. An article published in Life magazine in 1970 suggested that machines would reach human intelligence within three to five years, which required significant advancements in storage capacity and computational power.

In the 1980s, two key technologies were developed: deep learning, which allowed machines to learn through experience, and the expert system, which simulates human decision-making abilities. Computers began to rely on "if-then" reasoning to answer questions.

In 1997, Dragon Systems developed a speech recognition solution for the Windows system. By the early 21st century, improvements in productivity and storage, such as cloud computing, contributed to the increased use of computers and highlighted the role of artificial intelligence.

Today, artificial intelligence is advancing rapidly, driven by three key developments:

Graphics Processing Units (GPUs): The demands of the video and gaming industry led to the development of better and more affordable graphics processing units, which are essential for AI solutions.

Big Data: Artificial intelligence algorithms are trained on vast amounts of data, which helps them process information at an exceptionally high speed, making it more accessible and usable.

Algorithms: Algorithms allow for the automation of tasks that previously required human intervention, with continuous improvements in their effectiveness and complexity through layers of variables that sort and optimize results.⁴

AI, or machine intelligence, and the machines supporting AI are capable of the following: voice recognition, learning, planning, troubleshooting, logic, visualization, and the ability to handle and move objects.

3. Types of Artificial Intelligence

Artificial intelligence (AI) has rapidly advanced in recent years and has gained a prominent place in the business world. More companies are working to integrate AI solutions to improve efficiency, make informed decisions, and create personalized customer experiences. However, AI is a vast field, and there are different types of AI designed specifically to meet particular business needs.

A. Weak or Specialized Artificial Intelligence:

Weak AI, also known as specialized AI, is designed to perform a specific task. For example, Netflix's recommendation systems analyze your viewing habits to suggest movies and TV shows. Similarly, voice assistants like Siri and Alexa from Apple and Amazon are programmed to respond to voice commands and perform simple tasks.

B. Strong or Generalized Artificial Intelligence:

Strong AI remains largely theoretical and aims to replicate human intelligence as a whole. This form of AI, known in English as Artificial General Intelligence (AGI), would be capable of general thinking and independent learning, but it raises complex ethical and technical questions.⁵

C. Super intelligent Artificial Intelligence:

Super intelligent AI would be capable of experiencing emotions, developing needs and beliefs, and going beyond merely understanding human feelings.⁶

4. Artificial Intelligence and Our Daily Lives:

Artificial Intelligence (AI) is expected to become the "key technology of the future," but how will AI impact our daily lives?

A. Assisting People in Their Daily Lives:

AI is present in recommendation algorithms used on audio and video streaming platforms like Spotify and Netflix, which aim to suggest content based on users' past listening or viewing behaviors. AI also plays a crucial role in search engines like Google, enabling users to access relevant content by entering keywords. However, search results are not solely based on the query but also consider users' browsing history and geographic location.

B. Enhancing Healthcare and Medicine:

With connected devices like smart watches and health apps, monitoring and analyzing health indicators have become easier. The latest smart watch models now offer blood oxygen level measurement as a preventive tool for diseases like COVID-19. Similarly, glucose monitoring patches linked to mobile apps can send alerts when irregularities in blood sugar levels are detected.

C. Improving Learning and Training:

AI enhances education and training by facilitating faster and more efficient data exchange. As the volume of online learning resources grows exponentially, intelligent tools are becoming more accessible. AI is making significant strides in research and education, from scientific laboratories to classrooms with students of different academic levels.

D. Reducing Errors:

AI helps minimize human errors and improves accuracy by automating repetitive and error-prone tasks such as data entry, document verification, and quality control. By handling these routine tasks, AI allows employees to focus on more complex and creative responsibilities, reducing the likelihood of mistakes.

E. Advancing Transportation and Automotive Technology:

The transportation and automotive industries are experiencing innovation through AI. Many modern vehicles are now "smart," featuring AI-driven systems that detect a driver's surroundings and assist with semi-autonomous driving. Future advancements may enable fully autonomous driving. In major cities, smart public transport solutions, such as metro and tram systems, are becoming more common. The automotive industry is also benefiting from AI-driven developments like emergency braking systems, lane detection, and automatic headlight activation.

F. Security and Defense:

AI plays a critical role in advanced security solutions, including intelligent surveillance, intrusion detection, and autonomous drone management. AI-driven systems can quickly analyze real-time data to respond to potential threats more effectively.

G. AI in Justice and Law Enforcement:

Every internet user leaves behind a digital footprint through transactions like credit card usage, transportation records, and mobile phone activities. AI and big data help law enforcement agencies utilize this information in criminal investigations. Techniques such as geolocation tracking, facial recognition, and online transaction analysis provide reliable evidence for ensuring public safety.

H. AI and Food Quality:

AI is a vital tool in the agri-food industry, optimizing distribution processes and assessing the quality of available food products. AI applications extend across the entire food production chain, from agriculture to consumer storage, improving efficiency and ensuring better food safety standards.

5. Artificial Intelligence: Misuse and Ethical Concerns:

The risk of information manipulation and widespread misinformation has become a major concern for companies and AI experts. For example, Deepfake technology is increasingly being used to manipulate public opinion, as evidenced by the emergence of altered video and audio content.

These technologies enable the creation of false yet highly convincing images and videos capable of influencing political processes and society. In 2024, an estimated four billion people across more than 60 countries will vote; the growing use of AI in this context could seriously undermine elections by generating fake campaigns or spreading misleading messages.

A striking example of this misuse includes AI-generated imitations of Joe Biden's voice during the U.S. primaries or the creation of a video featuring Indonesia's Suharto urging people to vote for a political party in Indonesia.⁷

Ethical concerns surrounding AI include issues of privacy and data security, as well as automated decisions that impact individuals' lives. The widespread use of AI in collecting and analyzing personal data raises significant concerns about privacy protection and information security. Moreover, AI-driven decisions—such as automated credit assessments or judicial rulings based on algorithms—raise questions about fairness and

justice.

As for the current limitations of AI, they lie in its ability to understand context and handle complex decision-making independently. These systems sometimes struggle to interpret ambiguous situations or take emotional factors into account when making decisions. Despite its advancements, AI still cannot fully replace human capabilities in many fields.⁸

Qatar possesses several fundamental elements that support the adoption of artificial intelligence. These can be outlined as follows:

5.1 Internet Speed and Mobile Services:

According to the "Digital 2021" report by Hootsuite, a company specializing in social media, Qatar ranked first globally in mobile internet speed, with a connection speed of 178.01 Mbps.

The report highlighted that Qatar leads the world in internet adoption, with a usage rate of 99%. It provided an overview of the global digital landscape through statistics on the number of telecom service subscribers in various countries, their internet connectivity rates, social media usage, and other telecommunications-related data.

The "Digital 2021" report revealed that the number of internet users in Qatar reached 2.88 million, with 2.87 million individuals actively using social media. Additionally, statistics indicated that mobile phone subscriptions in Qatar totaled 4.67 million, representing a subscription rate of 160.6% compared to the country's population.

Qatar is considered a global leader in information technology, boasting one of the most advanced infrastructures in the world. The country has adopted cutting-edge technologies, such as 5G networks, and has an exceptionally high fiber-optic network penetration rate of 99%, placing it at the forefront of global rankings in terms of digital quality of life and internet accessibility.

5.2 E-Government Maturity Index :

Qatar has achieved advanced positions both internationally and regionally (in the Middle East and North Africa) in the Digital Government Maturity Index published by the World Bank in 2022. The country received an (A) classification among the leading nations in digital government

maturity, with a maturity score of 87.4%.

The World Bank ranks countries globally in digital transformation and government technology maturity into four groups (A, B, C, D). Group (A) includes countries that have attained a "very high" level of government technology maturity and digital transformation in the public sector, while Group (B) represents countries with a "high" level of maturity. Qatar ranked third regionally and 16th globally out of 198 countries assessed in the index. The country performed exceptionally well across all sub-indicators, placing it among the most advanced nations with an (A) rating.

The sub-indicators include: Availability of core government systems: Qatar ranked fifth regionally and 33rd globally with a score of 83.3%.

Digital government services delivery: Qatar ranked third regionally and 21st globally with a score of 95.4%.

Citizen engagement: Qatar ranked third regionally and 17th globally with a score of 93.1%.

Enablers of digital transformation: Qatar ranked seventh regionally and 49th globally with a score of 77.9%.

5.3 Innovation Hubs and Startups:

Qatar Science & Technology Park serves as a hub for research and innovation, attracting industry leaders and startups from around the world. Prominent global members include Siemens, Cisco, Shell, Mitsubishi, and ConocoPhillips.

5.4 Building Smart Cities for the Future:

Qatar is committed to ensuring that its innovative youth have access to futuristic cities that foster creativity without limits. These advanced urban areas feature:

- City-wide Wi-Fi coverage
- Integrated ICT infrastructure
- Modern cloud computing services
- Latest advancements in sustainable development

Lusail City, known as Qatar's smart city, implements efficient energy strategies and aims to reduce carbon emissions. For example, its central cooling system will cut 65 million tons of CO₂ emissions annually once

fully operational. Similarly, Msheireb Downtown Doha is a leading sustainable urban development model, using smart grids and sensors to enhance energy efficiency and minimize environmental impact.

5.5 Leading AI Rankings:

Qatar ranked 24th globally and second in the Arab world in the 2023 Technological Advancement Index, published by Global Finance, placing it ahead of several European and American countries.

Additionally, in the 2022 Global AI Index by Tortoise Media, Qatar ranked third in the Arab world. This index tracks AI development in countries investing in the technology, recognizing its significant impact on business, government, and society.

6. Global AI Summit in Qatar:

Qatar is set to host the Middle East and North Africa edition of the Global AI Summit in late 2024. This event will serve as an interactive platform for:

Government institutions, Major tech companies, Startups, Investors, AI developers

The summit aims to establish a strong AI ecosystem in the MENA region, encourage innovation, and provide opportunities for IT sector development. It will facilitate the exchange of cutting-edge ideas and help transfer global AI expertise to Qatar, reinforcing its goal to become a regional and global AI hub.

Qatar's Efforts in AI Development , Qatar has demonstrated strong commitment to AI advancement through:

- The establishment of the AI Committee
- The launch of Qatar's AI Strategy (2024-2030)

These initiatives highlight the country's dedication to positioning itself as a leader in AI-driven innovation.

7. Artificial Intelligence Committee in Qatar Amid intense:

International competition to develop artificial intelligence (AI) capabilities and technologies, Qatar recognized early on the importance of this technology and established the Artificial Intelligence Committee under the supervision of the Ministry of Communications and Information

Technology, following Cabinet Decision No. 10 of 2021. The committee members were appointed by Ministerial Decision No. 10 of 2022. Since then, the committee has been working on formulating a national AI strategy for Qatar.⁹

The committee is responsible for developing mechanisms to implement Qatar's AI strategy, monitoring its execution in collaboration with relevant ministries and institutions, and overseeing AI-related programs and initiatives launched by governmental bodies. It ensures that these initiatives reach various sectors and are implemented effectively. Additionally, the committee provides recommendations on human resource development plans for AI applications in collaboration with relevant state entities. It also proposes activities and events to support startups and scientific research in AI, necessitating the establishment of communication channels with international institutions and specialized organizations.

The committee follows the latest AI developments in coordination with relevant authorities and participates in local, regional, and international AI conferences and seminars. Regular reports are prepared to track the progress of Qatar's AI strategy.¹⁰

8. Qatar's Artificial Intelligence Strategy 2024/2030:

Qatar's AI strategy is built on six key pillars aimed at guiding the country towards a future centered on AI.

The first pillar focuses on talent competition. Given the widespread adoption of AI, Qatar is uniquely positioned to capitalize on this field. More than 94% of its population uses the internet, one of the highest rates globally. This exposure means Qataris frequently interact with AI-driven technologies such as computer vision, natural language processing, and digital mapping. Consequently, AI integration is an urgent necessity, and its education should be a fundamental part of curricula across all levels and disciplines. Students from kindergarten to secondary school must learn how to interact with AI recommendations and develop decision-making skills in uncertain situations. Older students should have opportunities to study the technical and philosophical aspects of AI, while educators should be trained in AI through professional or online courses. University computing

departments should ensure graduates are prepared for careers in science, technology, engineering, and AI applications.¹¹

To achieve this goal, an academically and experimentally strong AI curriculum must be developed, emphasizing project-based and activity-based learning from early childhood to secondary education. A strategic plan for AI applications should begin at an early age, establishing a solid foundation in computational methods, scientific, technological, engineering, and mathematical disciplines to develop future AI applications. The necessary competencies must be identified to create a supportive AI environment. Specialized training programs with certifications, such as AI-assisted medicine, should be introduced, allowing students to collaborate with researchers and businesses to develop applications tailored to Qatar's needs. This requires fostering a dynamic research and entrepreneurial ecosystem to create innovative AI applications. Strategies for attracting top AI talent globally should include offering competitive incentives, expediting residency processes, and ensuring seamless access to structured data for innovation. Additionally, policies should encourage the integration of locally developed solutions into Qatar's AI ecosystem.¹²

The second pillar emphasizes the importance of data accessibility. AI advancements rely heavily on big data, as modern AI models require vast datasets for training. Data is the primary resource driving AI progress, and its strategic management is crucial for gaining a competitive edge. Qatar can establish data governance regulations ensuring broad access while aligning with modern local privacy laws.

To achieve these objectives, a Qatar Data Strategy Office should be established to educate government and commercial institutions on data utilization as a strategic asset. Guidelines for data sharing must be developed, encouraging transparency and best practices. These principles should define data recipients' responsibilities and could evolve into mandatory policies, particularly concerning government data. Qatar should also lead multilateral diplomatic efforts to facilitate international data exchange among low-population-density countries. Successful AI application development and export revenue generation require broader

international cooperation in data sharing. Given Qatar's small, diverse population, its aggregated local data can be integrated and processed to enable its reuse for other purposes, thereby democratizing future AI application development.¹³

The third pillar addresses workforce transformation. Qatar has a population of approximately 3.5 million, with about 10% being Qatari citizens, while the rest are expatriates mainly employed in various sectors. Most Qataris working outside the military and security forces hold office jobs, particularly in the public sector, many of which are at risk of being fully replaced by AI or heavily reliant on it. For instance, 23% of Qatari men and 28% of Qatari women work in office jobs, among the highest rates globally for skilled office employment.¹⁴ By adopting AI and encouraging citizens to acquire AI skills, Qatar can become one of the first nations where its workforce and technology operate in harmony. To achieve this, financial incentives should be provided to local businesses that adopt AI solutions instead of relying on low-cost labor. Moreover, Qataris should be educated, trained, and encouraged to manage, develop, and invest in AI solutions to enhance living standards and economic productivity.¹⁵

The fourth pillar focuses on exploring new business and economic opportunities. Qatar boasts a modern and technologically advanced business environment, with a strong presence in the global oil and gas industry. The country also serves as a major aviation hub and has a robust financial sector and energy production infrastructure. AI is expected to drive significant transformations in Qatar's economy and business sector. Therefore, the national AI strategy must integrate this shift by enhancing local companies' ability to adopt AI technologies and fostering AI-driven business ventures. The Qatari government can support companies through guidance, best practices, and financial and technical assistance to implement AI. Additionally, funding should be allocated to support AI-focused startups.

Achieving these goals requires investments in AI-driven programs within Qatar's strategic sectors, such as oil and gas. A stable regulatory and incentive framework must be developed to attract global AI-specialized companies to invest and operate in Qatar. This also necessitates the

development and maintenance of advanced computing and communication infrastructure while ensuring high flexibility. Furthermore, Qatar should actively contribute to international efforts aimed at standardizing AI technologies across networks, systems, data integration protocols, and application requirements to ensure equal opportunities for all.¹⁶

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