

Reflections on Artificial Intelligence: Global Developments Through the Lens of Qatar's AI Strategy

Drawing on principles of philosophy, business, sociology, and technology, the following reflections provide readers with a high-level overview of Artificial Intelligence (AI), Qatar's AI strategy, 5 important (global) paradigm shifts, and interesting research insights that are relevant to any country competing in the AI age.

Key points for Qatari and non-Qatari actors:

1. Shift towards practical, project-based learning; AI is the “interactive book” and teachers set the context; creating space for physical encounters
2. Humans-in-the-loop!
3. Knowledge graphs for highly structured data; develop and own the datasets; shift from LLMs towards SLMs
4. Information integrity, verification, and the importance of trust; monetizing AI
5. Pursue investment opportunities in technologies complementary to AI, because “during a gold rush, you don't want to mine for gold, you want to sell picks and shovels”
 - a. Knowledge graphs for RAG and Ecosystem Intelligence
6. Developing a global, network-model-driven corporate intelligence system for monitoring opportunities and threats in real-time
7. Food security; AI in agriculture; creating the world's most efficient sourcing system...
8. What is intelligence, and what should we expect of a being we call “artificially” intelligent?

Introduction

Artificial intelligence, in my view (and despite its name), is not artificial. I understand that the word artificial was chosen to distinguish it from the natural intelligence found in living beings, but AI is not separate from human intelligence; it is an extension.

To phrase it more accurately, it is *engineered* intelligence, marked by human-initiated intervention, intellectual effort, and purposeful innovation. That means you also have to consider that it carries all

the biases, prejudices, and positive aspects of humans, as by calling it “artificial,” we risk treating it as an autonomous force, detached from its origins.

If, instead, we see it as an extension of human intelligence, then the real questions shift:

How do we align it with our values? How do we use it to augment our societies, our cultures, our strategies? Complement, and not replace, our people?

After all, AI can truly augment our capabilities, but we need to ensure that it is trained in a way we would like to see a human to be trained, and we all know that the training of humans is now more important than ever before. Please keep this in mind, also given that it is the foundation for the knowledge-based economy that Qatar strives for under its National Vision 2030.

Definition of AI

Metaphorically, AI is like the Wizard of Oz; everyone has heard about him, but hardly anyone really knows what he looks like.

What we see nowadays is mostly narrow AI, which refers to “AI” that performs very specific functions. Most of these systems rely on machine learning, from supervised and unsupervised approaches to reinforcement and even deep learning. Another core branch is natural language processing, which is responsible for translation tools, search engines, chatbots, and text generation. Then we also have computer vision, robotics, and expert systems, and (for the sake of space), I will leave it at that.

Before I start, I want to establish three things (dependent on contextual factors, of course):

1. AI combined with human intervention produces the most desirable results.
2. AI by itself should never entirely replace human intelligence, especially when the stakes are high.
3. One should not rely on AI, no matter how sophisticated, to always get the right answer or to always reach the right conclusion.

Qatar's Strategy: An Overview

Qatar National Vision 2030 (QNV2030) is the country's most recent iteration of its long-term vision, setting out a plan to transform Qatar into a diversified, knowledge-based economy. Here, AI is seen as a powerful enabler of that transformation, supporting all four pillars of QNV2030 across human, social, economic, and environmental development.

Qatar's National AI strategy builds on the country's broader brand and global presence, drawing on its identity as a guardian of Arab and Islamic traditions, its strength in energy and aviation, its role in global diplomacy, and its deep investments in education, culture, sports, and innovation. It was launched in 2019 by the Ministry of Transport and Communications together with Hamad Bin Khalifa University, and in 2021, the Artificial Intelligence Committee was established to coordinate AI governance and policy. To this end, the government has established a number of initiatives, including the Qatar Science and Technology Park (QSTP) and the Qatar Computing Research Institute (QCRI), which are dedicated to promoting innovation and supporting the development of AI technologies.

With Qatar having invested heavily in education and research and development over the last decade, such as the recent 2.5 billion dollar incentive package announced in May 2024, the goal is to leverage AI to secure its economic and strategic future, as envisioned by QNV2030, and to ensure that AI is adopted in ways that reflect local needs, values, and traditions.

A priority here is Qatar's shift towards a knowledge-based economy. This matters for two reasons:

- 1) People matter— As I mentioned earlier, the greatest results will come from human-machine collaboration, when AI augments human capability, rather than replacing it
- 2) Qatar is aiming to move from an economy based on hydrocarbons and downstream industries to one grounded in data and AI

*Just to preface, the majority of what I will share are the bits of the AI strategy that align most closely with the global trends and paradigm shifts that we identified in our own work for the Qatar Foundation (QF).

5 Relevant Shifts, Applied to Qatar's AI Strategy

1. The New Digital Divide

The first shift describes an emerging digital divide, also referred to by the United Nations as the *AI divide*, where some people feel empowered by AI tools, while others feel diminished or even

“dumber” after using them. What it really comes down to is whether AI is being used to augment or replace critical thinking, and it is a big focus for the human development pillar of QNV2030.

Pre-University Education

Regarding education, there is a global consensus that human-in-the-loop models in education are crucial, as AI can provide information and suggestions, but educators must set context, ensure accuracy, and teach students how to think with AI’s assistance. QF is enforcing this in its pre-university educational initiatives, leveraging AI tools as an interactive tutor in classrooms, with teachers serving as facilitators.

A paradigm shift to be aware of here is one toward more project-based learning. For example, while AI is the “interactive book,” the real learning in Qatar’s so-called AI + X future will come from “learning by doing”, through practical, project-based experiences. In this model, teachers become designers of learning environments, and peer-to-peer collaboration becomes just as important as instruction itself (honouring social skills).

And while AI can make us incredibly efficient, what really matters is what we do with the extra time it frees up, so education also needs to focus on creating space and downtime for analogue encounters. If our students finish their work faster only to spend the evening scrolling on social media, their brains will not grow; even worse, they will shrink. However, if they use that time to meet friends, go outside, or simply reflect, then that is when they, and we, start seeing the benefits of being more efficient with AI.

Higher Education and Workforce

When it comes to higher education, there are many examples, especially under Qatar’s Digital Agenda 2030, but the most recent one is Carnegie Mellon University in Qatar, launching its new Bachelor of Science in Artificial Intelligence.

Thanks to these initiatives, Qatar’s position in labor force AI preparedness, which is measured by how many of its AI-exposed jobs are the kind that can work with AI, is strong at 75% when compared to the averages of emerging markets (43 percent) and advanced economies (45 percent) according to the IMF and the Qatar Planning and Statistics Authority.

Furthermore, given that the majority of Qatari citizens are white-collar workers, a recommendation for the government is to leverage available supplementary and priority funding allocations, where appropriate, to fund rapid retraining for individuals impacted by AI-related job displacement. This

re-training should come more easily for Qatar, given that nearly 40% of economically active Qataris have a university education, which is one of the highest rates in the world.

2. Managing High-Risk AI with Human Oversight

Building on before, the second shift explores “humans-in-the-loop,” and how the size of that loop, so the scope of human oversight, may need to expand as AI systems grow more capable.

This is particularly relevant for Qatar’s Research, Development, and Innovation ecosystem, also given the emergence of automated, cloud-enabled labs. While Qatar already recognizes this through “Human Oversight Requirements” for AI systems used in sectors like finance and transportation, expanding the loop size is not easy. Involving more humans can slow processes, create new points of failure, and there is also a risk of “algorithmic complacency,” where humans trust the AI too much and fail to intervene even when needed.

Furthermore, what if “human-in-the-loop” is an illusion? Studies have shown that people are more likely to engage in unethical, harmful, and self-serving behaviour when they can blame the AI for it later on. A recent one from the Max Planck Institute for Human Development found that participants of the study were more likely to cheat when delegating to AI, especially when encouraging dishonest behaviour without explicitly saying it.

However, it also all connects back to education, because developing critical, informed humans is the foundation of responsible AI. To show you the importance of having a human-in-the-loop:

In 2017, scientists at the Laser Interferometer Gravitational-Wave Observatory detected gravitational waves from the collision of two neutron stars, an event never seen before. Their AI-configured automated data-processing programs had initially dismissed the signal as background noise because it did not match expected patterns, but it was human intuition that caught the anomaly and investigated it further, leading to one of the most important astrophysical discoveries of the century.

3. Data Quality Over Model Size: The Real Differentiator

The third shift is particularly relevant because it shows that in the age of AI, data is a more important differentiator than the model itself, as the quality, relevance, and volume of data used to train AI

models often determine performance more than the underlying large language model (LLM) architecture.

When it comes to having “perfect” data, experts we spoke with emphasized the growing importance of knowledge graph structures drawn from network science, because their highly structured nature provides exactly the kind of organized, high-quality data that is the “perfect” data to train any machine learning system.

I am sure you have heard of the phrase “garbage in, garbage out,” and the point here is that AI is only as good as the data it is trained on. It is a reminder that AI does not, and cannot, replace solid research and systematic human work. Which, again, highlights the importance of the knowledge-driven economy and intellectual capital.

This is why research professionals and academics in Qatar’s research ecosystem are so important, because humans are creative and still know how to ask the right questions, which is what drives discovery (like in the gravitational wave example from before), so you can not detach AI from a solid methodology or from a clear human-driven process.

Qatar is also aware of its unique advantage as a small country that is well connected administratively, which makes the development of broad data sharing guidelines possible. Apart from taking a leading role in multilateral efforts for data exchange and forming a coalition among small nations to ensure that they have an effective voice in global forums on such topics, experts raised another interesting recommendation for Qatar:

Become a leader in datasets and create datasets for the world.

Not only is this important for matters of data sovereignty, because data is key, but it is also crucial to overcome cultural bias in training AI models.

If Qatar develops the datasets, it has control over the data, and it can design the datasets with inclusivity in mind, to capture the nuances of local dialects and cultures. Then, when training LLMs on these datasets, Qatar can ensure that Arabic and Islamic traditions (currently are underrepresented in existing systems) are captured.

Please also keep in mind that there are now discussions regarding the importance of quality over quantity, because we used to believe that more data automatically meant better results, but we are now learning that that is not always true. Studies show that training LLMs on enormous, messy datasets can actually make performance worse because of overfitting, and through experiments, researchers

have also found that some smaller models outperform larger ones because they require fewer resources, can be retrained more frequently, and have faster response times to customer inquiries.

Above all, they are also way more sustainable in light of energy requirements, so in the future, there will likely be a trend towards smaller language models that are trained on structured, diverse, and validated data.

4. Safeguarding Information Integrity in the AI Era

The next shift highlights the growing challenge of safeguarding information integrity in the AI era. In a world of deepfakes, AI-generated text, and algorithmic misinformation, truth itself becomes harder to validate (just consider OpenAI's video-generating platform Sora that has been in the headlines because of how realistic it is).

Cybersecurity responses to this rest on three pillars:

1. Authenticating where information comes from
2. Ensuring content has not been altered (verification in transmission)
3. Creating incentives, such as policy-driven ones, for algorithms to favour truth and reliability and thus fight misinformation rather than spread it. This is important as currently, social media's reward structure (likes, shares) ends up amplifying false content

For Qatar, it is crucial going forward to invest in information accuracy and identify threats early on, whether through a national deepfake verification program or evidence rules for AI-generated media.

Another consideration is how to manage bots operated by foreign organizations inhabiting social media, as the kind of information people receive affects their perceptions a lot. For example, we saw what the recent Russian bot interference did in the Romanian elections, so there is definitely a need for sustained support to expand AI efforts in cybersecurity, whether through vulnerability management or building severe-but-plausible scenarios, and Qatar is already working on it through its National Cybersecurity Strategy 2024-2030 (specifically with initiatives such as Tanbih that can identify fake news and pinpoint its bias).

Conversations around these topics will also be important given the decisions about how AI will be monetized, and specifically the ethics behind the "ad model" route, where serving polarized content leads to more advertisement and more revenue.

5. Global Ecosystem Intelligence Monitoring

Lastly, the fifth shift is more of a recommendation to Qatar and any other model nation, and it is about pursuing investment opportunities in technologies that are complementary to AI because “during a gold rush, you don’t want to mine for gold, you want to sell picks and shovels.”

1. For starters, there is growing use of knowledge graphs together with AI for applications such as retrieval-augmented generation (RAG), where structured information is combined with generative AI to ground its outputs and reduce hallucinations, because we all know how dangerous it can be when AI starts to confidently make things up. This is relevant for everyone, but especially institutions like the QCRI...
2. A very important knowledge graph approach (in my humble opinion) concerns the development of a strong information strategy that monitors global intelligence, also referred to as “Ecosystem Intelligence”

Ecosystem Intelligence (EI) at its core is the ability to monitor global opportunities and threats in real-time and in a unique and structured way, based on network models of entire industries. It is essentially a new way of thinking about how we make decisions in a complex, interconnected world.

In a biological ecosystem, every organism affects every other, and the same is true for nations, companies, and industries. Like the name says, EI is intelligence about the ecosystems in which you operate globally, which encompasses the entire supply chain and all relevant actors in an industry of interest, helping us see those relationships clearly and act on them intelligently, making better-informed decisions (and detecting opportunities and threats early on).

Just imagine you are a decision-maker at a major agribusiness company in Qatar. Suddenly, a series of global disruptions hit– the U.S. imposes new tariffs on agricultural exports, droughts affect yields in South America, shipping routes in the Red Sea face new security threats, and, to make matters worse, two of your partner companies in Eastern Europe declare bankruptcy because of rising fertilizer costs.

These are developments that decision-makers must monitor closely, ideally in real-time, as in complex geopolitical and economic environments, it is no longer enough to look at developments in isolation.

So, knowledge graphs are cool because they enable such a system to be designed and arguably, every major nation, company, and investor today should have an ecosystem intelligence system in place to monitor opportunities and threats in real-time, as this is **the future of corporate intelligence**.

A Final Recommendation...

Before I close, I want to highlight another very important recommendation. Food security is a national priority for Qatar, and under its National Food Security Strategy 2030, the country has set ambitious targets to secure reliable and sustainable food supplies.

Locally, AI is already being used to optimize performance across controlled-environment greenhouses and vertical farms, but as a country with limited land and volatile climates, Qatar is also investing heavily in farmland abroad. For example, it plans to invest 1.5 billion USD in Ghana's agriculture sector by the end of the year, and Qatar's Al Jedad Holding has linked up with Ghana's Ministry of Food and Agriculture to build a 5 billion USD fertilizer production facility at the Petroleum Hub in Atuabo, in Ghana's Western region.

Importantly, when Qatar (or any other model country) invests in agriculture, whether locally or abroad, it should (when there is sufficient infrastructure), adopt the latest agricultural technologies in these places to farm in a much more efficient manner. These farms should serve as model or "smart" farms, and Qatar should thus lead by example, integrating cutting-edge machinery and data-driven systems across all operations, also making the country more sustainable in the process.

For example, on the field, Qatar could enforce the use of sensors in combination with machine vision to identify weeds among crops with remarkable precision, enabling robotic systems to use their actuators to remove them without or with very little pesticide use. This not only raises yields for farmers, since weeds take away nutrients from crops, but also protects soil health and biodiversity.

Beyond the field, there is a substantial market opportunity in combining quality assurance with end-to-end traceability, where Qatar could build one of the "most efficient sourcing systems in the world", serving as a stable, smart food supply chain for others in the region. This would allow the country not only to secure its own food supply and flourish in its investments but also to influence global standards of sustainability, **because one thing is investing and leaving the investment to do its own thing, and another is becoming active in the investment to help it generate even higher returns.**

Conclusion

Technology, as we all know, is a double-edged sword, and the combination of human intelligence with AI's inherent superiority in speed, accuracy, and memory-sharing ability will be formidable.

Since I began this paper by addressing the “artificial” in artificial intelligence, it is only fair, before I close, to turn to the second part of the name: intelligence.

So I invite you to reflect— what do we really mean by intelligence? Is it a psychological construct? A biological inheritance? Maybe processing power? The ability to solve problems with limited resources? Or, is it the wisdom to choose peace, fairness, and sustainability?

Because if we humans, who call ourselves intelligent, are still prone to conflict, prejudice, and short-sightedness, then what should we expect of a being we call artificially intelligent?

Please consider this when you develop and engage with AI directly, when you shape policy around it, or when you invest in our mutual future.

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