BUILDING AN AI-ENABLED ECONOMY: GLOBAL POLICY MODELS AND STRATEGIC DIRECTIONS FOR AZERBAIJAN

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Abstract: This paper examines how leading economies integrate artificial intelligence into national economic and business systems and evaluates the relevance of these experiences for Azerbaijan's emerging AI strategy. The study analyzes the strategic and legislative frameworks of the United States, China, and Spain, focusing on their approaches to innovation governance, sectoral prioritization, institutional design, and mechanisms that facilitate AI adoption by firms. The purpose of the research is to identify which elements of these international models can support Azerbaijan's transition toward a more diversified, knowledge-based economy. Using a comparative policy analysis, the paper reviews national AI strategies, regulatory acts, implementation tools, and public–private innovation infrastructures to assess their transferability to the South Caucasus context. The findings show that the United States demonstrates the strongest framework for commercialization and research–industry collaboration; China provides a structured sectoral planning model with measurable targets; and Spain offers a balanced, human-centric regulatory approach aligned with EU governance standards. When compared with these systems, Azerbaijan's strategy presents solid long-term ambitions but lacks detailed sectoral roadmaps, commercialization mechanisms, and trust-building governance tools. The paper concludes by proposing targeted recommendations for Azerbaijan, including AI commercialization hubs, sector-specific roadmaps, and an ethical governance package aligned with international best practices.

Keywords: Artificial Intelligence (AI); digital economy; economic transformation; comparative analysis; Azerbaijan

Introduction

The accelerating global transition toward AI-enabled economic systems has pushed countries to redefine how they regulate innovation, support business competitiveness, and structure long-term development strategies. Understanding these differences is essential for countries such as Azerbaijan, where AI integration is not only a technological priority but also a core component of broader economic restructuring.

The purpose of this research is to analyze how the United States, China, and Spain incorporate artificial intelligence into their economic and business policies, and to determine which elements of their experience are most relevant for improving Azerbaijan's national AI agenda for 2025–2028. Rather than evaluating AI as an isolated technological field, the study examines its strategic, regulatory, and institutional dimensions to capture how countries translate AI capabilities into economic outcomes.

The research method is a comparative policy analysis that systematically reviews national AI strategies, legislative acts, institutional mechanisms, and economic programs in the selected countries. This method allows the paper to identify structural similarities, divergences, and transferable policy instruments that fit Azerbaijan's developmental context.

The novelty and originality of the study stem from its focus on AI as a tool for economic modernization and business transformation, rather than treating it solely as a digital innovation. Existing literature rarely evaluates how advanced AI economies can inform the strategic development of transitioning economies, particularly within the South Caucasus. By synthesizing global practices

and aligning them with Azerbaijan's structural priorities, this research offers a unique, evidence-based perspective on how the country can close policy gaps, strengthen institutional readiness, and accelerate the economic benefits of AI adoption.

Discussions

Artificial intelligence has rapidly evolved from a specialized technological domain into a foundational driver of economic modernization, business transformation, and institutional efficiency. Across leading economies, AI now shapes national development agendas, influences global competitiveness, and redefines how states, firms, and societies organize production and decision-making. As countries formulate long-term strategies to harness these capabilities, differences in governance models, policy tools, and implementation mechanisms become increasingly visible—offering valuable lessons for states working to integrate AI into broader economic and institutional reforms. The present study examines these international experiences to evaluate how AI can be systematically incorporated into national development frameworks and what this implies for countries pursuing structural transformation.

The United States has constructed one of the most extensive and economically oriented AI governance ecosystems, grounded in a long tradition of technology-led growth, competitive markets, and innovation-driven entrepreneurship. The U.S. approach relies on a layered system in which federal strategies set long-term priorities, while private-sector dynamism accelerates adoption across industries. This structure reflects the broader American economic philosophy: competition-led growth supported by strategic public investment.

At the center of this ecosystem, the National AI Initiative Act (2020) serves as the foundational legislative framework, establishing a whole-of-government mechanism to coordinate federal research, support commercialization, and strengthen national competitiveness. Its design was heavily shaped by the National Security Commission on Artificial Intelligence (NSCAI), whose 2021 Final Report emphasized that U.S. leadership in AI requires integrated action across national security, economic competitiveness, research capacity, and workforce development. The NSCAI's assessment—that AI is a strategic infrastructure comparable to electricity or semiconductors—directly informed federal priorities by highlighting the need for robust public–private collaboration, advanced computing resources, trusted data environments, and targeted industrial policy. [NSCAI Final report, 2021, p. 27] Thus, the Act institutionalizes many of the Commission's recommendations by strengthening interagency coordination, accelerating translational research, and linking innovation to national resilience.

Through research infrastructure, public–private consortia, and targeted AI institutes, the Act embeds AI as a strategic enabler of industry modernization and business innovation. This legislative core is continuously reinforced by a series of Executive Orders that broaden the state's engagement with AI adoption. These orders encourage federal agencies to adopt AI tools, upgrade digital infrastructures, and create trustworthy standards that shape business incentives. Their combined effect is to accelerate the diffusion of AI technologies into the economy by reducing regulatory ambiguity, facilitating experimentation, and strengthening data ecosystems. These actions reflect a recognition—underscored repeatedly by the NSCAI—that regulatory clarity is essential for enabling firms, especially SMEs, to invest confidently in AI-powered solutions.

The core of this architecture is articulated in the National AI Initiative Act of 2020, which established a permanent and institutionalized coordination mechanism across federal agencies, public research institutions, and private-sector stakeholders. By formalizing interagency collaboration, the Act seeks to reduce fragmentation in AI policymaking and ensure coherence between research priorities, regulatory frameworks, and commercialization pathways. It positions the federal government not merely as a regulator, but as a strategic orchestrator of the national AI ecosystem, aligning scientific advancement with long-term economic and security objectives.

- First, the Act prioritizes advancing U.S. leadership in artificial intelligence research and development, recognizing innovation capacity as a cornerstone of global competitiveness. This objective is pursued through sustained federal funding allocations, the strengthening of national laboratories, and the development of coordinated, cross-agency AI research roadmaps. Emphasis is placed on foundational research, high-performance computing infrastructure, and mission-oriented AI applications in sectors such as healthcare, defense, energy, and transportation. By reducing duplication of efforts and encouraging interdisciplinary collaboration, the Act enhances the efficiency and strategic focus of public R&D investments.

- Second, the Initiative underscores the importance of developing trustworthy and ethical AI systems, reflecting growing societal and regulatory concerns over algorithmic bias, data privacy, cybersecurity, and accountability. The Act promotes transparency, robustness, and human-centered design as guiding principles for AI deployment, particularly in high-risk and socially sensitive domains. Through collaboration with standards-setting bodies and research institutions, it encourages the development of technical benchmarks and governance frameworks that balance innovation with public trust and democratic values.

- Third, a central pillar of the Act is supporting the training, recruitment, and retention of an AI-ready workforce. Recognizing human capital as a critical constraint in AI development, the Initiative supports new STEM education programmes, interdisciplinary curricula, federally funded research fellowships, and reskilling initiatives. Strong emphasis is placed on partnerships between universities, research centers, and industry to ensure that academic training aligns with real-world technological needs, thereby strengthening the talent pipeline across both public and private sectors.

- Finally, the Act highlights international cooperation and the protection of U.S. economic and national security interests, framing AI as both a strategic economic asset and a geopolitical instrument. While promoting collaboration with allied countries in research, standards development, and ethical governance, the Initiative also emphasizes safeguarding critical technologies from adversarial use. This dual approach reflects a broader strategy in which AI policy is integrated into foreign policy, trade, and national security planning, reinforcing the United States' position in an increasingly competitive global AI landscape [National AI Initiative Act of 2020, p. 24–25].

These priorities operate within an innovation ecosystem where the public and private sectors constantly interact. Many of the Act's underlying assumptions are consistent with empirical evidence on technological change. Sustained investment in general-purpose technologies generates durable productivity gains when research institutions and industry are jointly mobilized, for instance, aligns with findings that long-term R&D coordination is essential for national competitiveness. The U.S. framework embodies this logic by explicitly linking foundational research to commercialization pathways and high-skill employment.

A significant operational pillar of the American system is the NIST AI Risk Management Framework (2023), which—though voluntary—functions as a national standard for assessing security, robustness, fairness, and reliability. This flexible, use-case-neutral design allows organizations of different scales to implement risk controls without constraining experimentation. Such modular approaches echo broader insights in innovation economics showing that adaptive regulatory instruments often enable more rapid diffusion of new technologies than rigid statutory regimes [NIST AI Risk Management Framework (2023)]. The American model thus prioritizes scalability and experimentation, reflecting its dynamic innovation culture.

While federal policies shape strategic direction, the private sector remains the engine of applied development. U.S. firms allocate vast financial and computational resources to AI infrastructure, large-scale model training, and sectoral applications—from manufacturing optimization to logistics, predictive maintenance, cybersecurity, and financial analytics. This environment aligns with research

indicating that countries with deep capital markets and strong entrepreneurial ecosystems tend to achieve faster productivity gains from AI adoption due to higher absorptive. The NSCAI similarly stressed that private-sector innovation is indispensable for sustaining national leadership, calling for predictable federal investment and reduced barriers to deployment. The American experience illustrates this dynamic: policy sets the conditions, but firms drive the transformation.

Workforce development constitutes another central dimension. AI-related talent programmes, federal scholarships, and university–industry research networks aim to expand the expertise needed to support long-term competitiveness. The emphasis on human capital reflects a broader understanding that frontier technologies produce their highest economic returns when paired with specialized skills and institutional capacity—an observation widely supported in economic literature on skill-biased technological change. This focus directly responds to NSCAI's identification of talent development as the single most important factor for sustained leadership. The U.S. strategy therefore treats education not merely as a supporting component but as an integral part of technological leadership.

Regulatory policy, meanwhile, remains intentionally decentralized. Instead of imposing a comprehensive federal AI law, the United States allows agencies, states, and industries to adopt differentiated standards tailored to context. This fragmented structure generates debates about consistency and accountability, yet it supports rapid scaling and continuous innovation. It also enables sector-specific experimentation, especially in areas such as healthcare data analytics, autonomous systems, and digital platforms. Where more stability is required, federal guidance and executive orders provide guardrails, particularly for public-sector AI procurement, cybersecurity, and ethical requirements. NSCAI argued that such flexible regulatory architectures are necessary to preserve innovation velocity while preventing strategic vulnerabilities.

The U.S. model stands apart for its combination of structural coordination—anchored by the National AI Initiative Act and shaped significantly by the NSCAI—with market-driven scale, flexible regulation, and deep research capacity. These features position AI as both an economic catalyst and a component of geopolitical advantage. Compared with Spain's structured regulatory model and Azerbaijan's transformation-oriented strategy, the American approach reflects a mature innovation ecosystem where scientific leadership, entrepreneurial competition, and security-driven strategic planning jointly drive national AI capabilities.

Building on the U.S. experience—where federal coordination, standardized risk management, and a market-led innovation ecosystem form the backbone of AI advancement—China represents a contrasting but equally influential model in the global landscape of AI-driven economic transformation. While the United States accelerates AI adoption through competition, entrepreneurship, and flexible governance, China relies on long-term planning, state-coordinated investment, and rapid industrial integration. [Khanal, S., Zhang, H., & Taeihagh, A, 2025, p. 24] This structural difference not only shapes the pace and direction of AI deployment but also determines how firms, industries, and regional ecosystems internalize the economic potential of artificial intelligence.

China's AI governance framework is anchored in the New Generation Artificial Intelligence Development Plan (AIDP, 2017), a comprehensive and centrally coordinated national strategy that explicitly positions artificial intelligence as a "strategic technology for international competitiveness and national security." Unlike more market-driven governance models, the AIDP reflects China's state-led developmental approach, in which long-term technological priorities are defined at the national level and implemented through coordinated action across government ministries, state-owned enterprises, private technology firms, and research institutions. The plan integrates AI development into China's broader industrial policy agenda, linking technological advancement with economic restructuring, social governance, and geopolitical influence.

The AIDP establishes a clear three-stage roadmap for achieving global AI leadership:

First, by 2020, the plan targeted foundational progress in AI standards, core algorithms, data infrastructure, and enabling technologies. This phase emphasized building a robust technological base through increased public investment in basic research, the expansion of national AI laboratories, and

the development of regulatory and technical standards to guide early-stage adoption. These efforts aimed to reduce dependence on foreign technologies and strengthen domestic innovation capacity.

Second, by 2025, the strategy envisions world-leading breakthroughs in applied AI, particularly in strategically prioritized sectors such as advanced manufacturing, healthcare, smart cities, and agriculture. At this stage, AI is positioned as a key driver of industrial upgrading, productivity growth, and public service optimization. The plan promotes large-scale pilot projects, industry–academia collaboration, and the commercialization of AI technologies, enabling their diffusion across both traditional and emerging industries.

Finally, by 2030, the AIDP sets the ambitious goal of achieving global AI leadership, with a domestic AI industry exceeding USD 150 billion and AI technologies deeply embedded across all sectors of the national economy. This stage reflects a transition from adoption and adaptation to global norm-setting, where China seeks not only technological leadership but also influence over international standards, governance models, and ethical frameworks. AI is thus framed as a core pillar of national power, reinforcing China's economic resilience, technological sovereignty, and strategic autonomy [New Generation Artificial Intelligence Development Plan (AIDP, 2017), p. 7].

Crucially, AIDP does not operate in isolation; it is embedded in China's broader economic development architecture. It reinforces the objectives of Made in China 2025, which prioritizes intelligent manufacturing, industrial robotics, digital factories, and high-tech supply chain automation. Through this alignment, China merges AI adoption with industrial upgrading, enabling simultaneous advances in productivity, production precision, and export competitiveness.

The practical impact of these policies is strongly visible in the manufacturing sector, where AI-driven automation, predictive maintenance, and process optimization have become central to competitiveness. This dynamic is consistent with empirical evidence showing that Chinese firms with integrated digital and AI capabilities achieve significantly higher productivity and operational efficiency than traditional firms (Journal of Economic Structures, 2023, p. 9). These improvements reflect not only technological sophistication but also China's deliberate construction of an integrated innovation system—one that connects research institutions, industrial clusters, provincial governments, and state-owned enterprises into a single developmental network.

At the regulatory level, China has developed several legislative instruments that guide responsible AI deployment. The Cybersecurity Law (2017), Data Security Law (2021), and Personal Information Protection Law (2021) form the foundation of data governance, shaping how firms collect, store, and use information. Additionally, the CAC's Provisions on Algorithmic Recommendation Services (2022) and Interim Measures for Generative AI Services (2023) regulate algorithmic transparency, content governance, and model accountability. These instruments differ from U.S. frameworks in both structure and purpose: instead of emphasizing voluntary standards, China embeds AI governance directly into binding regulatory mechanisms that reflect national security priorities and social risk considerations.

A distinctive feature of China's AI economy is the heavy involvement of digital platform giants. Companies such as Alibaba, Tencent, Baidu, and Huawei operate expansive AI ecosystems that combine cloud computing, big data resources, chip development, and industrial AI solutions. Their platforms function as both commercial enterprises and national technological infrastructure. They enable rapid AI diffusion by providing SMEs with ready-made tools—cloud-based machine learning, automated marketing systems, logistics optimization engines, and customer analytics solutions. Evidence indicates that such digital empowerment substantially improves innovation output and cost efficiency among small and medium enterprises [X.Gao, Hua Feng, 2023, p. 17], showing that China's AI influence extends beyond large corporations into the broader entrepreneurial environment.

China's financial sector has also become a laboratory for AI-driven economic modernization. AI-enabled credit scoring, automated compliance, and risk analytics have expanded financial inclusion and reduced transaction costs across consumer and business markets. However, these innovations also introduce systemic risks such as algorithmic bias, data concentration, and platform dominance,

prompting ongoing regulatory responses. China's dual focus—promoting innovation while centralizing oversight—demonstrates its attempt to maintain stability in a fast-expanding digital economy.

Finally, China's strategy incorporates regional experimentation. Provinces like Beijing, Shanghai, Guangdong, Zhejiang, and Anhui run AI pilot zones, creating specialized clusters for autonomous vehicles, smart manufacturing, fintech, and digital trade. These zones allow policy experimentation, accelerate commercialization cycles, and create competitive pressure between regions—mechanisms that contribute to rapid national diffusion.

China's AI strategy illustrates how a state-coordinated ecosystem can accelerate economic transformation. AI is positioned not only as a technological asset but also as a cornerstone of industrial upgrading, digital sovereignty, and global competitiveness. Compared with the U.S. system, China offers a model characterized by stronger central planning, deeper integration with industrial policy, and more extensive regulation of data and digital platforms. For Azerbaijan, China's experience demonstrates the value of multi-level coordination, long-term industrial planning, and strategic investment in AI-enabled manufacturing, logistics, and SME digitalization—areas that align closely with Azerbaijan's economic diversification objectives.

After analysis of the United States and China, let's take a look at Spain experience. Spain's strategic posture demonstrates how a mid-sized European economy aligns national capabilities with continental regulatory ambitions. While the previous sections highlighted how innovation-driven and state-directed models shape AI development, Spain illustrates a hybrid approach: combining strong EU-level legal alignment with domestic policies that prioritize ethical governance, industrial modernization, and the social inclusiveness of digital transformation. As a result, AI becomes not merely a technological priority, but a structural policy tool for balanced regional development, productivity growth, and business competitiveness.

Spain's Estrategia Nacional de Inteligencia Artificial (ENIA, 2020) serves as the country's principal blueprint for long-term AI deployment. Its core objective is to integrate AI into priority domains—including industry, public administration, mobility, education, and health—while ensuring that technological expansion remains socially responsible, territorially cohesive, and ethically aligned. ENIA operationalizes this vision through six interconnected lines of action, each addressing a foundational challenge in Spain's digital transition:

- Enhancing scientific research and AI talent by improving R&D capacity and strengthening links between universities, research centers, and industry.
- Promoting business adoption of AI, especially among SMEs, by supporting experimentation, pilots, and sector-specific digitalization programmes.
- Developing digital infrastructures and data platforms to support scaling of AI solutions across the economy.
- Enabling safe regulatory environments and regulatory sandboxes to test emerging AI applications before full-scale deployment.
- Integrating AI into public administration to improve service efficiency, transparency, and citizen-oriented digital solutions.
- Fostering national and European value chains, including through strategic investments and coordinated industrial policies.
- Strengthening ethical, trustworthy, and human-centric AI governance, anticipating risks while supporting innovation. [ENIA, 2020, p. 10]

Together, these strategic lines aim to narrow Spain's historical productivity gap relative to northern Europe and to support SME digitalization—an essential objective given that SMEs account for more than 99% of Spanish enterprises. Moreover, ENIA explicitly integrates a territorial cohesion perspective by encouraging AI diffusion beyond metropolitan hubs such as Madrid, Barcelona, and Valencia, ensuring that less industrialized regions also benefit from digital modernization.

This long-term strategic direction is reinforced by the Plan de Recuperación, Transformación y Resiliencia (PRTR), supported by EU NextGeneration financing. Within this structure, the España Digital 2026 agenda translates ENIA's vision into short- and medium-term actions: expanding national data infrastructures, enhancing cybersecurity resilience, accelerating SME digitalization, and incentivizing AI adoption in sectors such as logistics, agriculture, advanced manufacturing, and tourism. Given tourism's central role in Spain's economy, AI-driven optimization of visitor flows, pricing systems, and service personalization represents a major pillar of Digital Spain's implementation logic. The interaction between ENIA (strategic vision) and España Digital 2026 (operational execution) creates a dual-channel governance model that combines long-term structural transformation with measurable technological milestones.

Spain's integration into the European AI ecosystem further shapes domestic policy. The EU AI Act, with its binding requirements on transparency, data governance, and high-risk system oversight, directs how Spanish firms build and deploy AI solutions. While compliance introduces adaptation costs—particularly for SMEs—the long-term effect aligns with empirical arguments that harmonized regulatory systems reduce uncertainty and stimulate investment by clarifying operational standards across large markets. And also well-structured digital governance tends to accelerate diffusion of general-purpose technologies by enabling firms to internalize predictable implementation pathways (p. 138). Spain's regulatory trajectory reflects precisely this type of predictable governance environment.

Research capacity also forms a central pillar of Spain's approach. National R&D programmes, as well as investments in applied research infrastructures such as the Barcelona Supercomputing Center, strengthen the innovation ecosystem necessary for advanced AI commercialization. This corresponds with broader economic observations that strong public–private research linkages increase countries' "absorptive capacity," determining how effectively firms convert general-purpose technologies into productivity gains. Spain's strategic investments thus aim not only to generate research but also to ensure that research outcomes translate into industrial capabilities.

In parallel, the country's economic structure offers fertile ground for AI uptake. Spain's manufacturing base—automotive production, pharmaceuticals, and food processing—has increasingly integrated AI models for predictive maintenance, supply-chain optimization, and energy-efficiency management. Service sectors such as tourism and finance apply machine learning for demand forecasting, customer profiling, and risk analytics. While Spain still trails northern Europe in overall adoption rates, the combined impact of ENIA, España Digital 2026, PRTR funding, and the EU AI Act is steadily narrowing these gaps by lowering knowledge barriers, incentivizing experimentation, and reducing market uncertainty. This reflects arguments that coordinated policy systems yield stronger economic returns from AI adoption than fragmented ones. [J.Bessen, 2022, p. 89]

Spain has reinforced ENIA with Digital Spain 2025, a comprehensive agenda positioning AI as a driver of productivity, sustainability, and administrative modernization. Digital Spain expands the AI framework into areas such as 5G deployment, cybersecurity, public service innovation, e-government, and digital rights. The strategy underlines that technological development must be accompanied by ethical safeguards, introducing the "Charter of Digital Rights" to protect citizens in AI-mediated environments. [Digital Spain 2025, p. 18]. This linkage between innovation and rights-based governance is a central feature of the Spanish–European model and provides an alternative reference point for Azerbaijan, which is seeking to ensure responsible AI adoption.

In 2024, Spain deepened its commitment with a new national AI strategy aimed at expanding computational capacity, supporting the development of Spain's own large language model (ALIA), strengthening cybersecurity capabilities, and creating a regulatory institution dedicated to oversight—the Spanish Agency for the Supervision of Artificial Intelligence (AESIA). AESIA represents one of the first national-level AI regulatory bodies in the EU, reflecting Spain's ambition not only to adopt AI but to govern it proactively). This evolution positions Spain as a frontrunner within Europe's human-centric AI vision.

Spain's AI governance model represents a balanced, integrative framework that aligns national development priorities with European regulatory harmonization, strengthens research capacity while enhancing ethical oversight, and supports business innovation without compromising social cohesion. By embedding AI within its broader modernization agenda, Spain not only prepares for technological transformation but positions itself as an active architect of an inclusive, sustainable, and regionally balanced digital economy.

As the analysis moves from Spain's EU-aligned regulatory model to the South Caucasus, Azerbaijan presents a different yet strategically coherent trajectory—one in which AI development is inseparable from the broader national objectives of economic diversification, institutional modernization, and transition toward knowledge-intensive growth. Unlike the mature innovation ecosystems of North America, Western Europe, or East Asia, Azerbaijan approaches AI not as an incremental enhancement to existing technological capacities but as a foundational instrument for reshaping its economic structure and reducing historical reliance on hydrocarbon revenues. This positions AI as a structural pillar within the country's long-term development vision rather than a standalone technological agenda.

Azerbaijan's overarching direction is set by "Azerbaijan 2030: National Priorities for Socio-Economic Development," which embeds digital transformation, human capital advancement, innovation-driven competitiveness, and sustainable economic restructuring at the center of future national development. Within this strategic architecture, AI functions simultaneously as an economic catalyst—enhancing productivity in traditional sectors—and as a governance tool, improving state-service efficiency, transparency, and decision-making quality. ["Azerbaijan 2030: National Priorities for Socio-Economic Development"] This vision aligns with global observations that countries undergoing economic transition tend to experience amplified gains from general-purpose technologies when policy coordination is strong and reform horizons extend over multiple planning cycles. Azerbaijan's long-term development priorities reflect precisely this coordinated strategic orientation.

The foundations of this orientation were laid through earlier initiatives such as the National Strategy for the Development of the Information Society (2014–2020), which expanded digital infrastructure, strengthened broadband accessibility, and supported e-government systems. [National Strategy for the Development of the Information Society] These developments created the baseline capacity necessary for more advanced AI applications. The sequencing—digital readiness preceding large-scale AI integration—mirrors global patterns of technological absorption, where infrastructure and digital literacy form prerequisites for effective AI. Azerbaijan's approach demonstrates such alignment between foundational capability-building and strategic technological upgrading.

Based on these foundations, institutional reforms have accelerated AI-related capacity development. The Innovation Agency, the High-Tech Park, the Azerbaijan Digital Hub initiative, and the modernization agenda of the Ministry of Digital Development and Transport collectively strengthen the ecosystem for technological entrepreneurship, support start-up formation, and promote public-private partnerships in digital services. These institutions foster technological experimentation in sectors such as transport, cross-border trade, customs automation, smart city development, and digital financial services. Their role corresponds with evidence that innovation agencies in transitioning economies serve as key intermediaries for expanding private-sector absorptive capacity and bridging structural gaps that typically hinder SME adoption of advanced technologies. Thus, institutional modernization in Azerbaijan forms part of a broader developmental rationale aimed at embedding technological competence across the economy.

This evolving policy landscape is now consolidated in the National Artificial Intelligence Strategy of Azerbaijan for 2025–2028, the country's first dedicated AI roadmap. The strategy articulates a comprehensive vision structured around several core goals:

- establishing a competitive national AI ecosystem,
- developing AI-related human capital,
- promoting AI adoption in priority economic sectors,

- enhancing digital and data infrastructures,
- ensuring ethical, secure, and transparent use of AI, and integrating Azerbaijan into the global AI economy through international cooperation. [National Artificial Intelligence Strategy of Azerbaijan for 2025–2028]

These objectives are supported by strategic directions that emphasize research and innovation capacity, the creation of sector-specific AI platforms, the modernization of regulatory and cybersecurity frameworks, and the introduction of AI governance principles in public administration. The strategy also prioritizes the development of open data ecosystems, advanced analytics, and high-performance computing resources, recognizing them as essential enablers for both state-driven digital governance and private-sector AI integration. By aligning technological goals with economic-structural reforms, the strategy constructs a developmental path that uses AI as a mechanism for productivity enhancement, competitiveness, and export-oriented diversification.

AI adoption directly supports Azerbaijan's diversification agenda. In logistics and energy infrastructure, predictive analytics improve maintenance efficiency and reduce operational risks. In agriculture—one of the main non-oil focus areas—AI contributes to precision farming, real-time crop monitoring, and water-use optimization. Manufacturing firms increasingly experiment with automation, process optimization, and quality-control algorithms. It shows that resource-rich economies can accelerate diversification when AI investment is strategically targeted and supported by parallel improvements in digital infrastructure. Azerbaijan's sectoral modernization programs demonstrate such targeted intent.

The governance dimension further strengthens this trajectory. Azerbaijan's internationally recognized ASAN Service (ASAN Xidmət) model provides a strong institutional foundation for embedding AI into public service delivery. Machine-learning systems are being introduced in administrative workflows, fraud detection, and transaction processing, improving efficiency and reducing administrative burdens. While the country has not yet adopted a comprehensive AI law, ongoing policy discussions focus on data protection, algorithmic accountability, cybersecurity, and ethical AI principles. Compared with the highly codified regulatory model of Spain, Azerbaijan's approach is more flexible and experimental—reflecting its stage of institutional evolution—but this flexibility also increases the importance of establishing long-term regulatory coherence to ensure reliable and responsible future AI deployment.

Azerbaijan's strategic and legislative trajectory reveals a dynamic developmental model shaped by the imperatives of economic transformation, innovation-led growth, and institutional modernization. Rather than replicating the models of the United States, China, or Spain, Azerbaijan is developing an AI path tailored to its national context—balancing infrastructural investment, human capital development, sector-specific modernization, and emerging regulatory frameworks. AI is thus positioned not as an isolated technological agenda but as an integrated component of national progress and economic restructuring, enabling the country to navigate global technological shifts while strengthening its competitiveness in the post-oil era.

The comparative analysis of the United States, China, and Spain reveals several strategic components that Azerbaijan can meaningfully adapt to strengthen its emerging AI ecosystem. While the country has made notable progress in digital transformation and institutional modernization, the current architecture would benefit from targeted enhancements that improve innovation capacity, increase regulatory trust, and guide sectoral development with measurable outcomes. Drawing on the strengths of the three international models examined, three priority directions emerge as particularly relevant for Azerbaijan's next stage of AI policy evolution.

First, the American experience underscores the importance of strong commercialization mechanisms that connect research institutions with the private sector. In the United States, federally supported AI hubs play a critical role in transforming scientific knowledge into market-ready solutions, reducing the gap between laboratories and industry. Azerbaijan, whose innovation system still faces challenges in technology transfer, would benefit from establishing 2–3 sectoral AI Commercialization

Hubs in strategically chosen domains such as Energy and Industry, Agriculture and Food Systems, and Public Services and GovTech. These hubs would serve as platforms for applied research, prototyping, and pilot testing, helping firms—especially SMEs—experiment with AI tools in low-risk environments. Situating these hubs within existing technology parks in Baku and the regions would minimize infrastructure costs while accelerating collaboration between universities, research centers, and industrial actors. By allocating seed funding and inviting industry partners to co-develop solutions, Azerbaijan can replicate the U.S. model of ecosystem-driven innovation and significantly increase the commercialization rate of locally developed technologies.

Second, China's emphasis on long-term, sector-specific strategic planning provides a valuable template for Azerbaijan's structural transformation goals. China's success in scaling AI adoption is rooted not only in investment volume but also in the clarity of its sectoral roadmaps, each equipped with concrete targets, implementation schedules, and evaluation mechanisms. Azerbaijan's diversification agenda naturally aligns with such a planning approach. Developing detailed AI sectoral roadmaps for Energy and Oilfield Services, Agriculture and Agritech, Transport and Logistics, Tourism, and Public Administration would provide a coherent framework for decision-making and investment prioritization. These roadmaps should include KPIs such as adoption levels, productivity improvements, number of pilot projects, and human-capital requirements. To ensure relevance and technical accuracy, the roadmap design should be led by ministry-level taskforces working jointly with academia, industry associations, telecom operators, and digital service providers. Over a 12–18 month period, this process would create a clear, measurable, and strategically aligned national AI development trajectory—one capable of anchoring both domestic reforms and international cooperation.

Finally, Spain's governance model demonstrates that technological modernization must be matched with public trust, ethical safeguards, and tools that support responsible deployment. As Azerbaijan expands AI use in public services, agriculture, logistics, and industrial operations, the need for a transparent and human-centric regulatory environment becomes increasingly important. Adapting the Spanish approach, Azerbaijan could establish a National AI Ethics Statement supported by a voluntary "AI Quality Label" that certifies compliance with core principles such as transparency, fairness, explainability, and data protection. This label could be tied to eligibility for participation in government-funded pilot programs or public procurement processes, thereby incentivizing responsible development without imposing immediate heavy regulatory burdens on emerging firms. The development of this framework should involve ethicists, civil society, business representatives, and technical experts, ensuring that the resulting guidelines are both internationally aligned and locally applicable. Providing SMEs with a practical checklist would further support widespread, trustworthy AI adoption across the economy.

These three strategic priorities—AI commercialization hubs, sectoral roadmaps with measurable targets, and a human-centric governance package—offer a balanced and realistic pathway for strengthening Azerbaijan's AI ecosystem. Each draw on international best practices while remaining aligned with Azerbaijan's institutional capacities, economic structure, and long-term development vision. If implemented cohesively, they would not only accelerate technological absorption and innovation but also reinforce public trust, enhance regulatory clarity, and position Azerbaijan more competitively within the global AI landscape.

Conclusion

This study demonstrates that artificial intelligence has become a structural driver of economic transformation rather than a standalone technological innovation. The comparative analysis of the United States, China, Spain, and Azerbaijan shows that effective AI integration depends on coordinated strategy, institutional capacity, sectoral prioritization, and governance mechanisms that balance innovation with trust. Although national models differ in form and execution, all successful approaches embed AI within broader economic, industrial, and regulatory frameworks.

The United States illustrates how strong research–industry linkages, flexible regulatory instruments, and market-driven innovation accelerate AI commercialization. China highlights the effectiveness of long-term, state-coordinated planning and sector-specific roadmaps in rapidly scaling AI adoption across manufacturing, logistics, and digital platforms. Spain demonstrates how ethical governance, SME-focused support, and regulatory predictability—shaped by EU standards—can foster inclusive and sustainable AI diffusion. Together, these models confirm that fragmented or purely technology-focused policies are insufficient to realize AI's full economic potential.

Against this background, Azerbaijan's emerging AI strategy reflects clear ambition and growing institutional readiness, particularly in linking AI development to economic diversification, public-sector modernization, and human capital formation. However, the analysis indicates that further progress requires moving from high-level strategic objectives to concrete implementation tools. In particular, Azerbaijan would benefit from strengthening AI commercialization mechanisms, introducing sector-specific roadmaps with measurable targets, and developing a human-centric governance framework to enhance trust and regulatory clarity.

Overall, the findings suggest that Azerbaijan's AI trajectory should follow a context-specific path rather than replicating advanced economies' models. By selectively adapting international best practices to its institutional and economic structure, Azerbaijan can leverage AI as a catalyst for productivity growth, post-oil diversification, and long-term competitiveness. The successful integration of AI will ultimately depend on policy coherence, institutional coordination, and the ability to translate technological potential into measurable economic outcomes.

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