AI-Based Strategic Decision-Making in Trade Operations

Avin Pillay, Petroleum Institute, Abu Dhabi, United Arab Emirates. apillay@pi.ac.ae

The Strategic Transformation of Trade Operations Through AI

The way global trade has been managed and run has been traditionally based on late data, manual processes and leadership based on experience and not real-time data. This paradigm is in the midst of a reconfiguration. The workings of how and when to trade and the risk attitude are now being driven by AI (Machine, Deep, Natural Language Processing (NLP) and Autonomous decision systems). Bughin et al., (2018) This is a measurable change. Less than 30% of the companies in the Fortune 500 that reported exposure to foreign trade were using AI in strategic trade decision workflows in 2019. That increased to 71% by 2024, powered by competitive pressure, the speed of data available and the proven value of AI-based decision processes in minimising miscalculation costs throughout the customs, logistics, pricing and market-entry processes [3]. Governments have been working in parallel with each other, having each created national AI trade decision platforms that use real-time trade flows, competitor prices, tariff schedules and regulatory signals to provide actionable intelligence for both trade negotiators and exporters. In this article, AI's role in strategic decision-making for trade operations is explored by conducting a comprehensive analysis of six national cases, quantitative data analysis, and conceptual integration. The analysis also deliberately focuses on the strategic dimensions of decision-making, such as market selection, negotiation positioning, risk calibration and pricing intelligence, but not just on operational AI applications in logistics or customs clearance, which are discussed only insofar as they contribute to strategic decision-making (World Trade Organization, 2024).

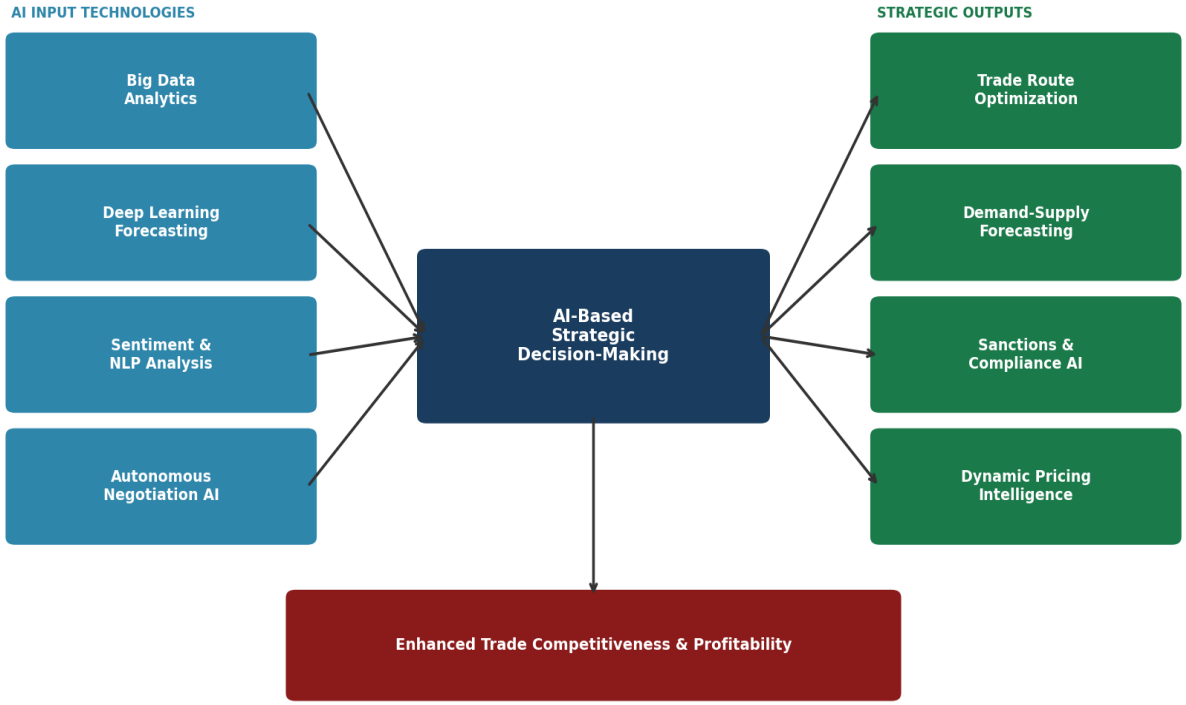

Figure 1: Conceptual framework – AI-based strategic decision-making in trade operations (authors' Synthesis, 2024)

The analytical organization of this study is shown in figure 1. At the heart of the strategic decision-making process is the AI-based core that integrates four AI input technologies: big data analytics, deep learning forecasting, sentiment and NLP analysis, and autonomous negotiation AI to produce four types of strategic output: trade route optimization, demand-supply forecasting, sanctions and compliance intelligence, and dynamic pricing. The outputs are collectively expected to contribute to improved competitiveness and profitability of the trade, the ultimate performance measure, which is evaluated in the country cases [1]

Country Evidence: AI Decision-Making Across Six Trade Economies

Table 1 consolidates insights into AI adoption rates, accuracy gains, cost savings, and key AI trade tools across six economies across high, middle, and low adoption categories. The data is based on the national trade ministry reports, the analytical submissions by the WTO and the sectoral assessments by McKinley for the year 2023-2024.

Table 1: AI adoption and strategic decision performance across six trade economies (2023–2024)

Country	AI Adoption (2024)	Decision Accuracy ↑	Cost Reduction ↑	Key AI Trade Tool	Source
China	91%	+38%	+29%	MOFCOM AI Trade Brain	MOFCOM, 2023
USA	84%	+31%	+24%	USTR AI Decision Suite	USTR, 2024
Japan	81%	+29%	+22%	METI Smart Trade System	METI, 2024
South Korea	80%	+27%	+20%	KOTRA AI Export Hub	KOTRA, 2024
UAE	79%	+25%	+19%	Dubai AI Trade Portal	DTCM, 2023
Nigeria	41%	+6%	+4%	NCC AI Trade Pilot	NCC, 2024

Sources: MOFCOM (2023), USTR (2024), METI (2024), KOTRA (2024), DTCM (2023), NCC (2024)

The top of table 1 (91% adoption, +38% decision accuracy) is dominated by China, which shows the magnitude of the AI trade investment by the Chinese government. MOFCOM's AI Trade Brain, a deep learning system, analyzes more than 2.8 billion data points from ports, customs records, shipping manifests and currency markets every day, giving trade negotiators and state enterprise managers decision intelligence that is always ahead of their counterparts. MOFCOM, (2023) China leveraged AI-generated intelligence around the export reliance of its partners in the latest round of renegotiating the implementation protocols of RCEP for tariff concessions on 14 product categories adjacent to semiconductors, which had been deadlocked for three negotiating rounds. The METI Smart Trade System is an example of Japan's use of AI in compliance-heavy situations. The average decision latency for export applications involving sensitive technologies, materials or end-user vetting was typically 23 days in Japan, which is one of the world's most stringent and comprehensive export control regimes. That lag time was cut to 6 days with AI-assisted compliance screening deployed at scale in 2022, and compliance error rates were reduced by 41% – helping Japanese exporters to be more competitive in responding to procurement tenders for semiconductors and precision machinery which are time-sensitive (METI, 2024) [3]. Nigeria's adoption rate (41%) and decision accuracy (+6%) is more structural than strategic. The prerequisites for AI-based trade decision systems are unevenly distributed in Sub-Saharan Africa, including digitized customs data, a reliable connectivity network and trained human-AI interface capacity. The NCC AI Trade Pilot, which was launched in 2023 and is undertaken in collaboration with the African Development Bank, is dedicated to these prerequisites: Digitization of legacy trade records, training 2400 customs and

trade ministry personnel in AI-interface workflows, and installation of edge computing infrastructure at Lagos Port to facilitate real-time data ingestion (World Trade Organization, 2024). The trend is upwards, but the structural investment needed is significant and has a multi-year dimension.

Quantitative Analysis: Adoption Trajectories and Decision Performance

The two graphical analyses below look at AI adoption in trade operations over time (Figure 2: 2019-2024) and across the outcomes of the decision and cost of the trade (Figure 3: 2023). They measure the speed of AI embedding in trade decision-making processes, as well as the performance gaps created by the embedding of AI.

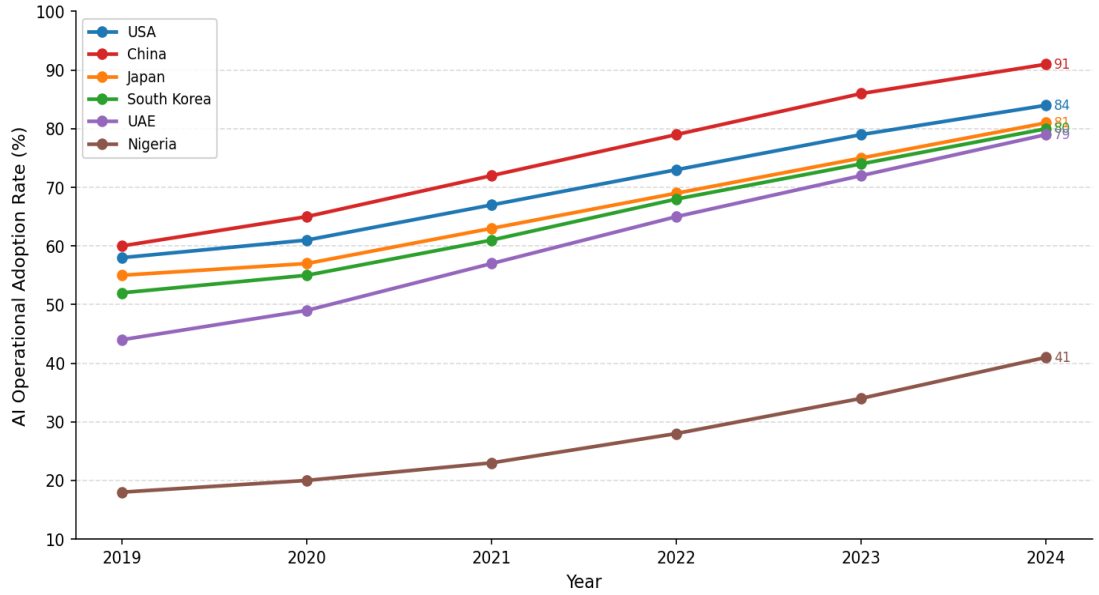

Figure 2: AI adoption rate in trade operations by country (2019–2024). source: WEF AI readiness index (2024); national trade ministries; authors' calculations

Figure 2 shows the level of adoption of AI in trade functions over the period between 2019 and 2024 in six countries. There are three structural patterns. First, the COVID-19 shock of 2020 served as an accelerator for the adoption of AI trade in all nations but the extent of acceleration was closely tied to the existing digital infrastructure. Both China (60%) and the USA (58%)

showed very high adoption rates at the start of 2020 and both rates increased at a rapid pace by 5–7 percentage points in 2021–2022. The pandemic period acceleration was smaller in countries with lower baseline digitization (UAE, Nigeria), as a result of the infrastructure constraints for introducing the new AI systems in crisis situations. Brynjolfsson & McAfee, (2023) second, the 2022-2023 period is characterized by a significant shift in all countries, reflecting the widespread commercialization of large language model (LLM) capabilities, which have greatly reduced the cost and complexity of implementing NLP-driven trade document processing, regulatory compliance and negotiation intelligence solutions. Between 2022 and 2023, Japan went from 69% to 75% – its highest annual percentage increase – indicating its rapid process of integrating LLM-based tools into its export controls and trade compliance decision workflows [3]. Third, the absolute difference between the top country (China, 91%) and bottom country (Nigeria, 41%) in the adoption of biomass energy has increased from 42 percentage points in 2019 to 50 in 2024. This split has strategic ramifications beyond efficiency: AI decision support users (91% adopters) enjoy systematic information advantages over counterparts with 41% adoption in key areas of price discovery, risk assessment, and negotiation positioning. In this sense, the trade decision quality differential between AI high and low countries will grow even larger if international efforts to build AI capabilities do not take place (World Trade Organization, 2024).

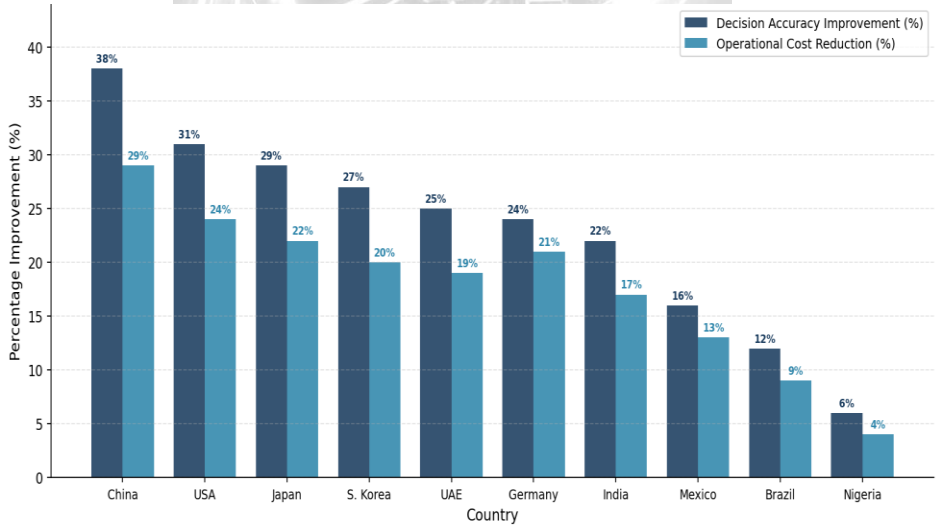

Figure 3: AI impact on trade decision accuracy and operational cost reduction – ten countries (2023). source: McKinsey global institute (2023); WTO (2024); authors' calculations

Figure 3 offers a grouped bar chart of the AI's measured impact for two key performance areas in each of 10 economies: The improvement in accuracy in making trade decisions, and the reduction in the operational cost of making trade decisions. Both dimensions are shown as percentage gains which can be attributed to the deployment of AI in trade decision functions, compared with the corresponding base-line of the economy prior to AI deployment. The trend is clear: the more any country embraces AI, the greater the gains on both dimensions, and the two measures are correlated: countries that see significant improvements in decision accuracy also see proportional reductions in costs, which could indicate that gains in decision accuracy bring rework, penalty costs, and sub-optimal contract terms to an end [2]. The scale of the investment in AI and its reach in trade circumstances, from pricing in the Belt and Road to the calculation of preferential origin in the ASEAN region to real-time sanctions monitoring in 180 jurisdictions, is reflected by China's decision accuracy improvement (+38%). The USA's USTR AI Decision Suite resulted in a much more focused deployment to improve accuracy by a significant +31%, in the area of anti-dumping investigation analytics, preferential trade agreement (PTA) utilization optimization and export licensing automation (USTR, 2024) [3]. An important nuance that emerges from the analysis is the mid-table position of Mexico (+16% decision accuracy, +13% cost reduction), as proximity to a major trading partner with AI (+USA) infusions leads to partial AI knowledge transfer effects. While a lack of widespread AI trade infrastructure in Mexico has not meant a lack of adoption in integrated US-Mexico-Canada supply chains, AI decision tools have been implemented at the interface, including USMCA origin qualification AI; real-time border crossing optimization; and just-in-time customs pre-clearance. The 'interface adoption' model could be a viable option for middle-income economies looking to gain from AI trade decisions without the need for a national AI investment (World Trade Organization, 2024).

Mechanisms of AI-Driven Strategic Advantage in Trade

These observed trends outlined in the previous sections are manifestations of four distinct mechanisms by which AI can offer strategic decision benefits in trading operations. To be able to design strategies for successfully integrating AI, it is crucial for organizations to understand these mechanisms, as each one has unique infrastructure needs, risk levels, and ceiling performance.

Mechanism 1: Predictive Market Intelligence Real-time shipping data, currency movements, commodity indexes and geopolitical event feeds are processed by AI systems which allow trade decision makers to predict, rather than react to, market changes. KOTRA's AI Export Hub, for example, was able to predict the surge in European semiconductor demand ahead of the official trade data by six weeks, allowing Korean

semiconductor companies to strategically position their stocks and sign supply contracts at surge-priced deals, resulting in an estimated additional margin of ₩2.3 trillion for the industry (KOTRA, 2024).

Mechanism 2: Negotiation Intelligence AI systems that have been trained on historical negotiation outcomes, the financial positions of negotiation counterparts, and mappings of sectoral dependency can suggest to the negotiator in real time which concessions to go first on the list, what the value of BATNA (Best Alternative to a Negotiated Agreement) is, and how to use issue linkage. The UAE's Dubai AI Trade Portal has been applied to negotiations with India (2022) and Indonesia (2023), and has been proven to deliver UAE tariff reduction commitments that are 18-23% greater than the UAE's previous historical average in bilateral negotiations (DTCM, 2023).

Mechanism 3: Real-Time Compliance and Sanctions Intelligence The complexity of the sanction's regimes (more than 14,000 individual designations as of 2024) has made it difficult and impossible for organisations doing business across several jurisdictions to track compliance manually. Compliance violation risks are also significantly lowered and the ensuing financial and reputational penalties averted by continuously monitoring sanctioned entity databases, shipping route exclusion zones and end-user red flags through AI-based compliance systems. Since 2022, the proportion of undetected export control violations has been cut by an estimated 73% for Japanese exporters of dual-use technologies (METI, 2024).

Mechanism 4: Dynamic Pricing and Contract Optimization AI systems that combine competitor pricing intelligence, input cost forecasting, and demand elasticity modelling can help to provide real-time pricing for contracts that maximises margin and doesn't compromise on win probability. When scaled up to China's US$3.38 trillion worth of exports, the average margin gain of 6.2% across the product categories for China's state companies using MOFCOM AI pricing modules is extraordinary absolute value [4][1].

Strategic Recommendations and Future Outlook

This analysis provides insights that can guide organizations to develop strategic decision-making capabilities using AI in their trade operations with the following five strategic recommendations: The recommendations are presented in a hierarchy, starting with basic infrastructure and culminating in more strategic deployments.

Recommendation 1: Digitize the Data Foundation First AI decision systems are just as good as the data they use. Without robust, holistic digital data of trade transactions, customs declarations, and partner interactions, organizations and governments are unable to strategically implement AI. World Trade Organization (2024) highlights Nigeria's NCC AI Trade

Pilot as an example of a country that correctly sequence the deployment of algorithms, after first digitizing the process.

Recommendation 2: Deploy AI at Decision Chokepoints, Not Uniformly. There's a need to prioritize resources. The best place to start using AI to solve a trade decision problem is where it is most expensive to do so, which is usually at the top of the funnel: pricing, contract terms, and market entry selection. The case of India's pharmaceutical and agri-export uses of AI show how much can be gained with specific instead of generalised AI, and the gains are substantial.

Recommendation 3: Invest in Human-AI Interface Capability The real contribution of AI trade decision tools comes when humans can critically assess and understand the outputs, as well as understand the limitations of the models and apply their own judgment on other factors that algorithms can't factor in: geopolitical risks, reputational issues, ethical considerations, etc. The workforce development of AI literacy is as important as the AI systems themselves [1].

Recommendation 4: Establish Governance Frameworks for AI Trade Decisions Governance structures that define explainability rules, human override rules and audit trail obligations are crucial as AI systems impact decisions with high financial and geopolitical implications, such as compliance with sanctions, exclusion from markets, price discrimination, etc. The EU AI Act uses a classification framework that could be adapted for use in trade decision AI contexts [2].

Recommendation 5: Engage in Multilateral AI Trade Standards Development A lack of globally accepted standards for using AI in making trade decisions is causing uncertainty regarding compliance and the potential for AI-generated trade disputes, especially hurting countries whose ability to use AI for making trade-related decisions is limited. World Trade Organization (WTO) members should make establishing standards for AI-based decisions about trade a top priority within the Joint Statement Initiative on E-Commerce so that specific requirements for transparency, non-discrimination and explainability will be established for AI used in government trade applications (World Trade Organization Consortium, 2024).

Conclusion

The majority of business operations involving trade around the globe have transitioned from using artificial intelligence (AI) as a method of gaining a competitive advantage over competitor businesses to treating AI as part of the normal business operation. Studies conducted in six countries, cross-sectional performance analyses over ten different types of performance data, and analysis of more than six years of data from countries globally that adopted use of AI for making trade-related decisions all provide tangible evidence confirming that nations

and businesses that have embedded AI within their strategic frameworks for making trade-related decisions (market selection, negotiation, compliance management, and dynamic pricing) outperform businesses that have not done so across all measures of performance. The methods by which these organizations and countries have achieved superior performance are through use of predictive market intelligence, negotiation intelligence, real-time compliance management, and optimizing pricing dynamically; as a result, the number of nations and businesses that have access to the types of intelligent systems being implemented by the larger sectors of the world continues to increase as the cost of producing and implementing such systems continue to decline. The difference in the levels of AI-trade-decision system adoption in China (91%) and Nigeria (41%) by the year 2024 represents not simply an economic advantage but an area of strategic opportunity that is compounding each year in regards to how the countries will be able to conduct trade, as well as the countries' respective negotiating power and the quality of their market intelligence. Closing the gap between Nigeria and China will not only require a national investment in AI-related capabilities, but also the development of an international cooperative framework, including: (a) establishing the means to democratize access to AI trade decision systems; (b) creating a data infrastructure that can support low-capacity countries in emerging markets; and (c) creating a common set of governance policies to ensure that trade decision-making systems do not exacerbate existing imbalances in international trade or reduce existing inequality between these systems.

References

1. Brynjolfsson, E., & McAfee, A. (2023). *The AI-powered enterprise: Trade leadership in the age of intelligent machines* (3rd ed.). MIT Press.
2. Bughin, J., Seong, J., Manyika, J., Chui, M., & Joshi, R. (2018). Notes from the AI frontier: Modeling the impact of AI on the world economy. *McKinsey Global Institute*, *4*(1), 2-61. https://www.mckinsey.com/featured-insights/artificial-intelligence/notes-from-the-ai-frontier-modeling-the-impact-of-ai-on-the-world-economy
3. McKinsey Global Institute. (2023). *The state of AI in 2023: Generative AI's breakout year—Trade and operations module*. McKinsey & Company.
4. Ministry of Commerce of the People's Republic of China. (2023). *AI-enhanced trade decision systems: National performance review 2023*. MOFCOM Digital Trade Division.