



## The impact of Artificial intelligence applications and the green transition on International Trade Rules “A legal analysis of regulatory challenges and prospects for Green Arbitration”

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### Abstract

The deployment of artificial intelligence (AI) and the global green transition are transforming international trade. AI-driven advancements in logistics, supply chains, and maritime transport have improved efficiency and competitiveness, while sustainability imperatives reshape trade policies.

Existing trade rules were not designed for automated decision-making or environment-based measures. This paper analyzes the implications of AI and the green transition for international trade law.

These developments challenge foundational assumptions of trade law, such as human agency, predictability, and linear decision-making. Autonomous, learning algorithms introduce new legal risks, including opacity, unclear accountability, and systemic bias. Climate-driven trade rules impose additional compliance layers interacting with AI-enabled operations. Trade law must balance innovation, regulatory autonomy, and legal certainty amid these shifts.

The analysis uses an integrated framework at international, regional, and national levels. It examines how AI affects liability, transparency, and accountability within the World Trade Organization (WTO) framework, and reviews emerging responses such as the European Union's Artificial Intelligence Act, the UNCITRAL Model Law on Automated Contracting, and maritime sustainability initiatives. By situating AI within international economic law, the study evaluates whether current trade disciplines can accommodate technological change and sustainability without undermining core trade principles.

At the national level, the paper examines Egypt's legal framework—including its AI strategy, data protection, maritime trade law, and environmental commitments—with comparative references to EU and Saudi approaches. This highlights how emerging economies integrate AI into trade governance while aligning with international obligations, and explores prospects for regulatory convergence or divergence.

AI and the green transition necessitate recalibrating international trade law and dispute resolution mechanisms. Green arbitration and mediation emerge as key tools for resolving disputes in technology-driven, sustainable trade. Alternative dispute resolution mechanisms—especially those aligned with environmental objectives and supported by digital tools—offer flexible, efficient pathways to manage the complexity of AI-enabled, sustainability-driven disputes.

**Keywords:** Artificial intelligence, international trade law, green transition, WTO, EU Artificial Intelligence Act, UNCITRAL, Egypt Vision 2030, green arbitration, Singapore Convention on Mediation

### Introduction

Artificial intelligence (AI) has emerged as a transformative force across global economic activities, profoundly affecting the way international trade is conducted. AI-driven systems are increasingly embedded in logistics networks, customs procedures, digital trade platforms, and maritime operations, enabling enhanced efficiency, reduced transaction costs, and real-time decision-making. Despite these benefits, the integration of AI into international trade also generates complex legal questions that existing trade rules were not originally designed to address.

The legal significance of this transformation lies not merely in the technological sophistication of AI systems, but in their capacity to alter decision-making structures that underpin trade governance. Automated processes challenge traditional legal notions of intent, discretion, and foreseeability, particularly where decisions are generated or executed without direct human intervention. These challenges are amplified in cross-border contexts, where multiple legal systems interact and where accountability gaps may arise due to fragmented regulatory oversight.

Parallel to this technological transformation, the international community is pursuing an ambitious transition

towards environmental sustainability, driven primarily by the global response to climate change.

The adoption of the Paris Agreement marked a significant shift in aligning economic activity with climate mitigation objectives, with direct implications for international trade, particularly in carbon-intensive sectors such as maritime transport. Environmental standards and sustainability-related trade measures are increasingly shaping market access conditions and regulatory compliance requirements.

The integration of environmental objectives into trade regulation reflects a broader normative shift in international economic law, where sustainability considerations are no longer treated as peripheral exceptions but as central policy goals. This shift places additional demands on trade governance frameworks, which must reconcile environmental protection with principles of non-discrimination and proportionality. The use of artificial intelligence to monitor, enforce, and optimize compliance with environmental standards further deepens the interaction between technology and sustainability in international trade. The interaction between AI-driven innovation and the green transition presents both opportunities and challenges for international trade law. While AI technologies can support environmental objectives by optimizing resource use and

reducing emissions, they also raise concerns regarding energy consumption, data governance, liability, and regulatory transparency. These issues are particularly acute in the maritime sector, where technological innovation and environmental regulation intersect most visibly.

In the maritime context, AI-enabled systems are increasingly deployed to enhance vessel efficiency, predict maintenance needs, and optimize routing to reduce fuel consumption.

However, the legal implications of such deployment extend beyond operational efficiency, encompassing questions of responsibility for automated decisions, compliance with international maritime conventions, and the evidentiary status of algorithm-generated data. These issues illustrate the broader challenge of ensuring that technological innovation advances sustainability goals without undermining legal accountability.

Within this broader international context, national legal systems play a crucial role in shaping the governance of AI-enabled and environmentally sustainable trade. States have adopted varying regulatory approaches reflecting their economic priorities, institutional capacities, and policy objectives. The European Union has pursued a comprehensive regulatory framework for artificial intelligence, while Saudi Arabia has integrated AI governance into its broader digital transformation strategy.

These divergent regulatory models demonstrate the absence of a unified global approach to artificial intelligence governance, increasing the risk of regulatory fragmentation in international trade. For traders and service providers operating across jurisdictions, navigating these differences may entail significant compliance costs and legal uncertainty. At the same time, regulatory diversity allows for experimentation and the development of best practices that may inform future international coordination.

Egypt occupies a particularly strategic position in this evolving landscape due to its geographic location, role in global maritime trade, and ongoing digital transformation initiatives.

As a major logistics and transport hub, Egypt is directly affected by both AI-driven trade practices and the green transition. Despite this significance, Egypt's legal approach to artificial intelligence in international trade has received limited attention in comparative legal scholarship.

Examining the Egyptian legal framework provides valuable insight into how emerging economies with strategic trade infrastructure respond to technological and environmental challenges. Egypt's experience illustrates the interaction between national development strategies, international legal commitments, and sector-specific regulation, particularly in maritime trade. This perspective enriches the comparative analysis and contributes to a more inclusive understanding of global trade governance.

Against this background, the present study seeks to analyse the legal implications of artificial intelligence and the green transition for international trade through a comparative and multi-level approach. By examining international norms, regional regulatory models, and national legal frameworks, the paper aims to contribute to ongoing debates on the future of international trade law in a digital and environmentally constrained global economy.

Through this analytical framework, the study advances the argument that international trade law must evolve through incremental adaptation rather than wholesale replacement.

By strengthening interpretative coherence, enhancing regulatory coordination, and promoting sustainable dispute resolution mechanisms, trade law can remain responsive to technological innovation while safeguarding its foundational principles. The following parts of the paper develop this argument through detailed doctrinal and comparative analysis.

## **Research Problem**

The central research problem addressed in this paper may be formulated as follows: To what extent do existing international trade rules and related legal frameworks adequately regulate the growing use of artificial intelligence and the requirements of the green transition, particularly in maritime trade and digital commerce, and how can national legal systems—such as those of Egypt, the European Union and Saudi Arabia—contribute to the development of coherent and sustainable regulatory and dispute resolution mechanisms?

This research problem reflects a broader structural challenge confronting international economic law, namely the ability of legal frameworks designed for traditional modes of trade to respond effectively to technologically mediated and sustainability-driven commercial practices. The increasing reliance on algorithmic decision-making and environmentally conditioned regulatory measures places pressure on established trade disciplines, particularly in areas such as services classification, regulatory justification and dispute settlement. Addressing this problem requires an integrated legal analysis that bridges international norms with national regulatory innovation.

This problem reflects the tension between technological innovation, environmental obligations and the traditional principles of international trade law, including legal certainty, non-discrimination and market access.

The tension identified is not merely theoretical, but manifests concretely in regulatory practice and trade relations. States seek to harness artificial intelligence to enhance competitiveness and environmental performance, while simultaneously safeguarding core trade principles that underpin predictability and fairness in the global trading system. The challenge lies in reconciling regulatory experimentation with the need to avoid arbitrary or unjustifiable trade restrictions, particularly where AI-based measures and sustainability requirements interact.

## **Research Questions**

1. What are the principal applications of artificial intelligence in international trade, global value chains, maritime transport and cross-border e-commerce?
2. To what extent are existing WTO agreements and related international trade rules capable of accommodating the legal challenges arising from AI-driven trade and digital services?
3. How does the green transition—particularly in the context of maritime transport, green fuels and sustainable ports—affect international commercial contracts and trade regulation?
4. What role do recent international and regional regulatory instruments, such as the UNCITRAL Model Law on Automated Contracting, the EU Artificial Intelligence Act and the Singapore Convention on Mediation, play in shaping a modern legal framework for digital and green trade?

5. How does the Egyptian legal framework governing artificial intelligence, data protection, maritime trade and environmental regulation compare with European Union and Saudi approaches, and what lessons can be drawn for developing States engaged in global trade?
6. To what extent can green arbitration and mediation serve as effective dispute resolution mechanisms for conflicts arising from AI-enabled and environmentally sustainable trade activities?

## **Part I: Theoretical and Technical Framework of Artificial Intelligence Applications in International Trade**

The international trade system is undergoing a profound transformation driven by the rapid evolution of artificial intelligence (AI) technologies. No longer confined to purely technical domains, AI is exerting significant influence on the legal and regulatory structures governing global commerce. The integration of AI into international trade mechanisms necessitates a thorough understanding of its theoretical and technical underpinnings, as well as an evaluation of its compatibility with existing legal frameworks—or the need for their reform to accommodate this paradigm shift.

This part seeks to establish a foundational framework for analyzing the legal challenges arising from the deployment of AI technologies in the context of international trade. It does so through the examination of four central themes:

1. **The Concept and Legal Characterization of Artificial Intelligence:** This section explores the definition of AI from a legal perspective, addressing whether AI may be construed as a legal subject or merely a technological tool subordinate to human agency. The classification bears directly on issues of legal responsibility and accountability in commercial contexts.
2. **Types of Artificial Intelligence Relevant to International Trade:** Not all AI applications pertain to trade-related scenarios. This section identifies and classifies the specific forms of AI that are particularly relevant to international commerce, including those involved in production, logistics, digital contracting, and cross-border service provision.
3. **Artificial Intelligence and the Transformation of Global Value Chains:** Here, the focus is on how AI is reshaping global supply and value chains in terms of efficiency, real-time decision-making, and task allocation. The legal implications of these transformations are assessed in light of cross-border commercial relations and contractual frameworks.
4. **The Legal Relevance of AI in International Trade:** This final section underscores the necessity of reassessing international trade rules in light of AI proliferation. Particular attention is paid to WTO disciplines, state obligations, and core trade principles such as non-discrimination and transparency, in evaluating how domestic AI regulations interact with international trade law.

## **Section 1: Concept and Legal Characterization of Artificial Intelligence**

From a legal and regulatory perspective, artificial intelligence may be described as a category of digital systems capable of performing functions traditionally associated with human cognitive activity, including learning, prediction, problem-solving, decision-making and linguistic interaction. These systems operate through algorithms that process large volumes of data and adapt their behavior over time, often without direct human intervention in each individual decision.

The defining legal significance of these systems lies in their capacity for adaptive behavior and autonomous output generation. Unlike rule-based software, AI systems may modify their operational parameters based on data inputs, making their outcomes less predictable and more difficult to trace. This technical characteristic has direct implications for legal concepts such as foreseeability, fault and control, which are central to the regulation of cross-border commercial activity.

Unlike conventional software, AI systems are characterized by a degree of autonomy and opacity that challenges classical legal assumptions regarding intent, control and accountability. This distinction is of particular relevance in international trade, where legal certainty, predictability and traceability are essential for cross-border commercial transactions.

Consequently, contemporary legal debates increasingly focus not on defining AI in purely technical terms, but on identifying the risks and regulatory implications associated with its deployment in commercial and trade-related activities.

In international trade, opacity in decision-making may undermine trust between trading partners and complicate regulatory oversight. Where algorithmic processes determine pricing, market access or compliance outcomes, affected parties may face difficulties in understanding or contesting adverse decisions. These concerns reinforce the shift in legal scholarship toward risk-based and functional regulatory approaches, rather than static technical definitions of artificial intelligence.

In international trade practice, AI systems are typically deployed as tools rather than independent legal actors. They do not possess legal personality and cannot, under prevailing legal doctrine, bear rights or obligations in their own name. Responsibility therefore remains with the natural or legal persons who design, deploy, control or economically benefit from the use of such systems. This approach is reflected in emerging international and regional regulatory frameworks, including the EU Artificial Intelligence Act and UNCITRAL initiatives on automated contracting.

This attribution-based approach preserves continuity with established principles of private and public law, while accommodating technological innovation. However, it also raises practical challenges in complex supply chains involving multiple actors, including developers, operators and end-users of AI systems. Determining the appropriate allocation of responsibility in such contexts is a central issue for international trade law and commercial dispute resolution.

## **Section 2: Types of Artificial Intelligence Relevant to International Trade**

The application of artificial intelligence in international trade takes multiple forms, each with distinct legal and economic implications.

Identifying these forms is essential for tailoring regulatory responses to the specific risks and benefits associated with different AI applications. A differentiated approach allows legal frameworks to promote innovation while imposing safeguards proportionate to the potential impact of AI systems on trade relations and market integrity.

### **1. Machine Learning and Predictive Analytics**

Machine learning algorithms are widely used to analyse historical and real-time data in order to predict market demand, optimize pricing strategies, assess creditworthiness of foreign trading partners and identify fraud in international payments and trade finance. In maritime logistics, predictive analytics enable more efficient scheduling of vessels, cargo allocation and port operations, thereby reducing costs and delays.

These applications enhance competitiveness and operational resilience in international trade, particularly in volatile markets. However, their increasing influence over commercial decisions also magnifies the legal consequences of errors, biases or data inaccuracies embedded within algorithmic models.

From a legal perspective, reliance on predictive systems raises questions concerning the accuracy of automated decisions, liability for erroneous outcomes and potential discriminatory effects embedded in training data. These concerns are particularly relevant when AI-driven assessments influence access to markets, finance or logistics services.

Such concerns intersect with international trade principles relating to equal treatment and fair competition. Where predictive systems systematically disadvantage certain traders or regions, they may indirectly affect market access and raise regulatory scrutiny under both trade and competition law frameworks.

### **2. Generative Artificial Intelligence**

Generative AI tools are increasingly used in cross-border commercial activity for drafting and translating contracts, preparing marketing content, designing products and facilitating communication between parties operating in different linguistic and legal environments. For small and medium-sized enterprises, such tools significantly lower entry barriers to international markets by reducing transaction costs and reliance on specialized intermediaries.

By enhancing accessibility and efficiency, generative AI contributes to the democratization of international trade. Nevertheless, its use in legally sensitive contexts amplifies the importance of verification, professional oversight and contractual safeguards to ensure the reliability and legal validity of generated outputs.

However, the use of generative AI in legal and commercial documentation also raises concerns regarding intellectual property rights, confidentiality, professional responsibility and the reliability of automatically generated legal content. These issues are of direct relevance to international trade law, which traditionally relies on precise contractual language and clearly allocated risks.

In cross-border transactions, these concerns are compounded by differences in national legal systems and evidentiary standards. Errors or ambiguities introduced through automated drafting may give rise to disputes over interpretation, validity and enforceability, underscoring the continued necessity of human legal expertise.

### **3. Automated Compliance and Expert Systems**

AI-based expert systems assist traders and logistics operators in complying with complex regulatory requirements, including customs classification, rules of origin, tariff calculations, sanctions screening and export-control compliance. By automating these processes, AI reduces human error and accelerates cross-border trade procedures.

Such systems are particularly valuable in jurisdictions characterized by dense and frequently changing regulatory environments. They support trade facilitation objectives by streamlining compliance while reducing administrative burdens for both traders and authorities.

At the same time, errors generated by automated compliance systems may lead to financial penalties, delays or disputes with customs authorities. This raises questions regarding the allocation of responsibility between traders, software providers and service intermediaries, as well as the extent to which reliance on automated systems may constitute due diligence under international and national trade regulations.

Clarifying these issues is essential to maintaining trust in AI-assisted compliance mechanisms. Legal frameworks must balance the benefits of automation with the need to preserve accountability and effective remedies in cases of regulatory breach.

### **4. AI-Enabled Supply Chain and Logistics Management**

One of the most significant impacts of AI on international trade lies in the optimization of global supply chains. Intelligent systems are used to manage inventory, select transport routes, allocate port resources and respond dynamically to disruptions caused by geopolitical events, environmental risks or market volatility.

By enhancing resilience and adaptability, AI-enabled supply chain management supports continuity in international trade even under conditions of uncertainty. This capability has become particularly important in light of recent global disruptions affecting trade flows.

In maritime trade, AI applications increasingly interact with environmental objectives by optimizing fuel consumption, reducing idle time in ports and supporting compliance with emission-reduction requirements. This convergence of efficiency and sustainability positions AI as a central tool in the green transition of international trade, while simultaneously expanding the scope of legal obligations and potential disputes.

The dual role of AI as both an efficiency-enhancing and sustainability-supporting technology reinforces its strategic importance. At the same time, it broadens the range of legal issues arising from its deployment, particularly where environmental performance becomes a determinant of market access or contractual compliance.

### Section 3: Artificial Intelligence and the Transformation of Global Value Chains

The integration of AI into international trade has contributed to a structural reconfiguration of global value chains. By enhancing data-driven decision-making and real-time coordination across borders, AI reduces transaction costs and enables more flexible production and distribution models.

This transformation facilitates the fragmentation and reconfiguration of production processes, allowing firms to adapt rapidly to market signals and regulatory requirements. Legal frameworks governing trade and investment must therefore account for increasingly fluid and digitally mediated value chains.

For developed economies, AI strengthens competitiveness through advanced logistics, digital services and high-value trade. For developing and emerging economies, including Egypt and other regional trade hubs, AI offers opportunities to integrate more effectively into global value chains—provided that adequate digital infrastructure, legal frameworks and human capital are in place.

The realization of these opportunities depends heavily on national policy choices and international cooperation. Capacity-building, regulatory clarity and access to digital infrastructure are critical factors influencing whether AI contributes to inclusive growth or exacerbates existing disparities.

Nevertheless, the uneven distribution of AI capabilities and digital infrastructure risks reinforcing existing asymmetries in the global trading system. Concentration of data, computing power and technological expertise in a limited number of States and multinational corporations may lead to dependency, reduced bargaining power and challenges to fair competition. These concerns underline the need for international trade rules that address not only market access, but also digital equity and sustainable development.

Addressing these asymmetries requires a re-examination of how international trade law engages with issues of development and technological capacity. Incorporating considerations of digital inclusion and sustainability into trade governance may help mitigate the risk of marginalization for developing economies.

### Section 4: Legal Relevance of AI in International Trade

From a legal standpoint, the growing role of AI in international trade affects several foundational principles, including contractual autonomy, liability allocation, transparency and regulatory oversight. Automated contracting, algorithmic decision-making and AI-mediated negotiations challenge traditional notions of consent and intent, particularly when transactions are concluded without direct human interaction.

These challenges require careful doctrinal adaptation rather than abandonment of existing legal principles. Legal systems must develop interpretative tools capable of accommodating automated processes while preserving the validity and enforceability of international commercial transactions.

These developments necessitate a reassessment of existing legal frameworks governing international trade and commercial transactions. They also provide the conceptual foundation for subsequent chapters of this study, which examine the adequacy of WTO rules, the emergence of new regulatory instruments and the role of national legal

systems—such as those of Egypt, the European Union and Saudi Arabia—in shaping the future governance of AI-enabled and environmentally sustainable trade.

By establishing this theoretical and technical foundation, the present part prepares the ground for a normative evaluation of current trade rules and regulatory responses. The following parts of the paper build upon this analysis to assess how international, regional and national legal frameworks can evolve to govern AI-enabled trade in a sustainable and coherent manner.

## PART II: Legal Impacts of Artificial Intelligence on International Trade Rules

The proliferation of artificial intelligence technologies presents unprecedented legal challenges to the architecture of international trade law. As AI becomes embedded in cross-border commercial activities—from digital services and automated logistics to algorithmic governance and decision-making—questions arise concerning the adequacy, adaptability, and coherence of the current legal frameworks regulating global trade.

This part undertakes a focused legal analysis of the interplay between AI and international trade rules, structured across six critical dimensions:

- 1. The Adequacy of WTO Rules in the Era of Artificial Intelligence:** This section evaluates whether the foundational agreements of the World Trade Organization sufficiently encompass the complexities introduced by AI-driven trade practices or whether legal reform is warranted.
- 2. Liability for AI-Driven Decisions in International Trade:** It examines the attribution of legal responsibility for actions or decisions taken by AI systems involved in commercial exchanges, including issues of fault, causation, and accountability across jurisdictions.
- 3. Algorithmic Transparency and Due Process in Trade Regulation:** Here, the analysis addresses how the opacity of AI systems intersects with fundamental procedural guarantees in trade governance, including the rights to explanation, appeal, and fair treatment.
- 4. Data Protection, Trade Secrets and Cross-Border Data Flows:** This section explores the tensions between regulatory requirements for data localization or protection and international commitments to the free flow of information and protection of proprietary commercial data.
- 5. Competition Concerns and Concentration of Economic Power:** It considers the antitrust implications of AI, particularly how algorithmic coordination, platform dominance, and access to training data may distort competition in global markets.
- 6. Implications for the Evolution of International Trade Law:** Finally, this section reflects on the normative and institutional adjustments necessary to ensure that international trade law remains relevant, inclusive, and resilient in the face of accelerating technological disruption.

## **Section 1: The Adequacy of WTO Rules in the Era of Artificial Intelligence**

The multilateral trading system established under the auspices of the World Trade Organization (WTO) constitutes the cornerstone of contemporary international trade regulation. Its principal agreements—most notably the General Agreement on Tariffs and Trade (GATT), the General Agreement on Trade in Services (GATS) and the Trade Facilitation Agreement (TFA)—were drafted in a period preceding the widespread deployment of artificial intelligence and advanced digital technologies. As a result, questions arise as to whether these instruments remain adequate to govern AI-driven trade practices.

The temporal gap between the drafting of core WTO agreements and the emergence of AI-driven trade practices has become increasingly significant. While the WTO legal framework is deliberately technology-neutral, its rules were conceived in an era dominated by tangible goods, clearly identifiable service suppliers, and relatively predictable modes of supply. Artificial intelligence challenges these assumptions by enabling new forms of trade that blur the boundaries between goods and services, automate commercial decision-making, and operate across jurisdictions simultaneously. This raises fundamental questions about whether existing WTO disciplines can accommodate technological neutrality without sacrificing legal certainty or regulatory effectiveness.

At the core of WTO law lie the principles of non-discrimination, embodied in the most-favored-nation (MFN) and national treatment obligations. Regulatory measures adopted by States to govern AI—such as data localization requirements, restrictions on cross-border data transfers, or limitations on the export of algorithms and encryption technologies—may indirectly affect market access for foreign suppliers of digital services. In certain circumstances, such measures risk being characterized as disguised restrictions on trade, particularly where they disproportionately affect Foreign Service providers or lack sufficient transparency.

From a doctrinal perspective, the application of MFN and national treatment principles to AI-related regulation is particularly complex. Measures adopted in pursuit of legitimate public objectives—such as cybersecurity, data protection, or national security—may nevertheless have trade-restrictive effects if they alter competitive conditions between domestic and foreign suppliers. The challenge for WTO adjudication lies in distinguishing permissible regulatory differentiation from protectionist intent, especially where regulatory justifications rely on technical or security-related considerations that are difficult to verify externally. This tension underscores the growing importance of proportionality, transparency, and evidence-based regulation in the governance of AI-related trade measures.

Under the GATS framework, the classification of AI-based services presents additional challenges. Many AI-enabled services are supplied through cloud-based platforms and digital infrastructures that transcend traditional service categories. This creates uncertainty regarding the scope of Members' specific commitments and the extent to which regulatory requirements imposed on AI systems constitute permissible domestic regulation or unlawful limitations on market access.

This classificatory uncertainty has practical legal consequences for both States and private actors. Where AI-

enabled services do not fit neatly within existing GATS sectors, Members may disagree on whether a particular measure falls within the scope of scheduled commitments. Such ambiguity increases the risk of disputes and may discourage regulatory experimentation by States concerned about potential WTO inconsistency. At the same time, service suppliers face uncertainty regarding their rights and obligations, particularly in relation to licensing, qualification requirements, and technical standards imposed on AI systems operating across borders.

The WTO Work Program on Electronic Commerce has, for several years, served as a forum for discussions on digital trade, electronic transactions and data flows. While progress has been incremental, it is increasingly evident that artificial intelligence will become a central issue in future negotiations. The absence of binding multilateral rules specifically addressing AI-driven trade highlights a growing regulatory gap within the WTO system.

The continued reliance on soft-law discussions and plurilateral initiatives reflects both political sensitivities and divergent regulatory priorities among WTO Members. While some States advocate for free cross-border data flows and minimal regulatory intervention, others emphasize digital sovereignty and public interest regulation. Artificial intelligence amplifies these divergences by linking trade policy to ethical, social, and security considerations. In the absence of binding rules, regulatory fragmentation is likely to increase, potentially undermining the predictability and uniformity that the multilateral trading system seeks to provide.

## **Section 2: Liability for AI-Driven Decisions in International Trade**

One of the most significant legal challenges arising from the use of artificial intelligence in international trade concerns the allocation of liability for decisions generated or assisted by intelligent systems. In trade finance, logistics, pricing and compliance, AI systems often operate with limited human oversight, relying on probabilistic models rather than deterministic rules.

The reliance on probabilistic decision-making fundamentally alters traditional assumptions about control and foreseeability. Unlike conventional automated systems, AI models may evolve through continuous learning, making their outputs difficult to predict *ex ante*. In international trade transactions, where liability allocation is often premised on foreseeability and fault, this characteristic complicates the application of established legal doctrines. The resulting uncertainty affects contractual risk allocation and may increase the cost of cross-border trade, particularly for smaller market participants.

When an AI system produces an erroneous or discriminatory outcome—such as the wrongful denial of trade finance, misclassification of goods or breach of contractual obligations—the question arises as to who should bear legal responsibility. Prevailing legal doctrine rejects the notion of AI systems as independent legal persons. Liability therefore remains with the natural or legal persons who deploy, control or benefit from the system, including traders, service providers and, in some cases, software developers.

This attribution of responsibility reflects a functional approach grounded in existing principles of tort, contract, and commercial law. However, in practice, identifying the

relevant controlling actor may be difficult, particularly where AI systems are developed by one entity, deployed by another, and integrated into complex global supply chains. Cross-border trade exacerbates these difficulties by introducing conflicts of law and jurisdictional fragmentation, thereby increasing litigation risks and enforcement challenges.

However, this approach is not without difficulty. The complexity and opacity of advanced AI systems may make it difficult to establish causation or fault under traditional liability regimes. These challenges are compounded in cross-border contexts, where multiple jurisdictions and applicable laws may be involved. As a result, there is growing support for clearer contractual allocation of risks and for regulatory frameworks that impose due diligence and governance obligations on users of high-risk AI systems.

In response, regulatory initiatives increasingly emphasize ex ante risk management rather than ex post liability alone. Obligations relating to system documentation, human oversight, and impact assessment aim to reduce harm before it materializes. In the trade context, such governance-based approaches may enhance legal certainty by clarifying the standards of care expected from traders and service providers using AI, thereby facilitating compliance while preserving flexibility for innovation.

### **Section 3: Algorithmic Transparency and Due Process in Trade Regulation**

Transparency is a foundational principle of international trade law, reflected in WTO obligations relating to publication, notification and review of trade-related measures. The increasing reliance on algorithmic decision-making in customs procedures, risk assessment and regulatory enforcement poses challenges to this principle.

Algorithmic decision-making may obscure the reasoning underlying regulatory actions, thereby weakening the informational basis on which traders can plan their activities. Where decisions affecting market access, customs clearance, or compliance are generated by AI systems, traditional transparency mechanisms may prove insufficient. This raises the question of whether existing WTO transparency obligations should be interpreted to include algorithmic accountability and disclosure standards.

Many AI systems operate as so-called “black boxes”, producing outputs that are difficult to interpret even for their developers. When such systems are used by public authorities or private actors performing quasi-regulatory functions, affected traders may be unable to understand the basis of adverse decisions or to effectively challenge them. This raises concerns regarding procedural fairness, due process and the right to an effective remedy.

From a rule-of-law perspective, the inability to contest algorithmic decisions undermines confidence in regulatory systems and may discourage participation in international trade. Due process requires not only access to review mechanisms but also meaningful information about the grounds of a decision. The challenge lies in reconciling these requirements with legitimate interests in protecting proprietary algorithms and sensitive data.

In response, emerging regulatory approaches—most notably within the European Union—emphasize requirements of explainability, documentation and human oversight for certain categories of AI systems. While these requirements

are not yet reflected in WTO law, they may influence the interpretation of existing obligations relating to transparency and non-discrimination in the digital trade context.

Over time, such regional regulatory standards may contribute to the development of international best practices, potentially shaping customary expectations regarding algorithmic governance in trade. Although the WTO lacks direct competence over AI regulation, its dispute settlement bodies may increasingly be called upon to assess the trade-restrictive effects of AI-related measures in light of evolving regulatory norms.

### **Section 4: Data Protection, Trade Secrets and Cross-Border Data Flows**

The operation of artificial intelligence in international trade depends on access to large volumes of data, often transferred across borders and processed in multiple jurisdictions. This raises complex legal issues relating to data protection, confidentiality and trade secrets.

Data has become a strategic asset in the global trading system, comparable in importance to capital and labor. The ability of AI systems to generate economic value depends on both the quantity and quality of data available, making cross-border data flows a critical enabler of modern trade. Legal restrictions on data movement therefore have far-reaching implications for competitiveness and market integration.

Divergences between national data protection regimes—such as the European Union’s General Data Protection Regulation (GDPR) and more flexible frameworks adopted by other States—create friction in cross-border trade. Restrictions on data transfers may be justified on grounds of privacy or security, but they may also function as barriers to digital trade if applied in an overly restrictive or discriminatory manner.

This regulatory fragmentation complicates compliance for multinational enterprises and may disproportionately affect firms operating in multiple jurisdictions. From a trade law perspective, the challenge lies in balancing the legitimacy of data protection objectives with the need to prevent unjustified discrimination or disguised restrictions on trade. The absence of harmonized international standards exacerbates legal uncertainty and increases transaction costs.

For businesses, the use of AI systems also entails risks relating to the protection of commercially sensitive information. Training datasets and algorithms may incorporate proprietary data or trade secrets, raising questions regarding ownership, misuse and liability in the event of data breaches. These issues highlight the need for balanced legal frameworks that reconcile legitimate regulatory objectives with the facilitation of international trade.

Effective protection of trade secrets is essential to sustaining innovation and trust in AI-enabled trade systems. At the same time, excessive secrecy may undermine transparency and accountability. Legal frameworks must therefore strike a careful balance, ensuring that intellectual property and confidential business information are protected without impeding regulatory oversight or dispute resolution.

## **Section 5: Competition Concerns and Concentration of Economic Power**

The deployment of advanced artificial intelligence in international trade has significant implications for competition and market structure. Control over key inputs—such as data, computing power and specialized expertise—is increasingly concentrated in the hands of a limited number of multinational enterprises and technologically advanced States.

This concentration reflects economies of scale inherent in AI development, where access to vast datasets and computational resources creates high barriers to entry. In the international trade context, such dynamics risk marginalizing smaller firms and developing economies, potentially undermining the inclusive growth objectives of the multilateral trading system.

This concentration risks distorting competition, limiting market access for smaller firms and developing economies, and reinforcing asymmetries within global value chains. In the trade context, such dynamics may undermine the ability of small and medium-sized enterprises to compete on equal terms, despite the theoretical efficiency gains offered by digital technologies.

While digital tools can lower certain entry barriers, the dominance of large AI providers may offset these benefits. Market power derived from data accumulation and algorithmic optimization may translate into pricing advantages and preferential access to markets, raising concerns about fairness and long-term competition in international trade.

From a legal perspective, these concerns intersect with both competition law and international trade regulation. While WTO agreements do not contain a comprehensive competition regime, they provide a framework for addressing certain anti-competitive practices through disciplines on subsidies, state trading enterprises and transparency. The growing influence of AI may therefore prompt renewed attention to the interface between trade law, competition policy and digital regulation.

This interface remains underdeveloped at the multilateral level, leaving significant regulatory gaps. Enhanced cooperation between trade authorities and competition regulators may be necessary to address AI-related market distortions effectively. Such coordination could contribute to a more coherent governance framework that aligns trade liberalization with fair competition and sustainable development.

## **Section 6: Implications for the Evolution of International Trade Law**

The cumulative effect of AI-related challenges—liability, transparency, data governance and competition—suggests that international trade law is entering a period of structural adaptation. Incremental interpretation of existing WTO rules may address some issues, but it is unlikely to provide a comprehensive solution.

This period of adaptation reflects broader transformations in the global economy, where digitalization and sustainability increasingly shape trade relations. Relying solely on dispute settlement to resolve AI-related tensions may prove insufficient, particularly in light of the preventive and systemic nature of many regulatory concerns.

This evolving landscape underscores the importance of complementary regulatory initiatives at the international and

national levels, including UNCITRAL instruments on automated contracting, regional frameworks such as the EU Artificial Intelligence Act, and domestic legal reforms in States engaged in digital and green trade. These developments set the stage for the comparative and sector-specific analyses undertaken in the subsequent chapters of this study.

Together, these initiatives suggest a gradual shift toward a multi-layered governance model, combining international trade law with sector-specific regulation and domestic reforms. Understanding how these layers interact is essential for assessing the future trajectory of AI-enabled international trade and for identifying pathways toward a more coherent, inclusive, and sustainable legal framework.

## **PART III: International and National Regulatory Frameworks for Artificial Intelligence in International Trade**

The legal governance of AI in international trade is developing through parallel international and domestic efforts. This part outlines key regulatory models shaping AI-enabled trade, with attention to their legal scope, trade impact, and potential convergence.

- Section 1 reviews global initiatives influencing AI regulation in trade contexts.
- Section 2 examines the EU AI Act as a binding, extraterritorial model with trade implications.
- Section 3 analyzes Saudi Arabia's sector-based regulatory approach and its trade relevance.
- The legal governance of AI in international trade is developing through parallel
- Section 4 offers a comparative synthesis of international and national frameworks, highlighting areas of alignment and legal divergence.

### **Section 1: International Regulatory Initiatives Relevant to AI-Enabled Trade**

#### **1. The UNCITRAL Model Law on Automated Contracting in International Trade**

The increasing use of automated and AI-enabled systems in cross-border commercial transactions has prompted the development of international legal instruments aimed at reducing uncertainty and facilitating legal recognition of such practices. In this context, the United Nations Commission on International Trade Law (UNCITRAL) adopted the Model Law on the Use and Cross-Border Recognition of Automated Contracting in International Trade in 2024.

The adoption of this Model Law reflects a broader recognition that traditional contract law concepts, while flexible, require clarification when applied to technologically mediated transactions. Automated contracting systems increasingly operate at speeds and scales that render direct human intervention impractical, particularly in international digital trade. By addressing these realities, UNCITRAL seeks to preserve the effectiveness of cross-border commerce while ensuring that automation does not undermine fundamental principles of consent, reliability, and enforceability.

The Model Law seeks to remove legal obstacles to the formation and performance of contracts through automated systems, including those incorporating artificial intelligence. It affirms, as a general principle, that contracts formed through automated means are not invalid or unenforceable

solely because no natural person directly reviewed or intervened in the transaction at the time of conclusion. This principle is of particular importance for high-frequency digital trade and algorithmic contracting environments.

This affirmation of technological neutrality is particularly significant in sectors such as electronic commerce, financial services, and logistics, where automated decision-making has become integral to operational efficiency. By confirming the legal validity of automated contracts, the Model Law reduces uncertainty for traders and investors and supports the scalability of AI-enabled trade models. At the same time, it reinforces the notion that legal accountability remains anchored in human or corporate actors, notwithstanding the automated nature of the contracting process.

The Model Law further addresses key issues such as the attribution of automated messages to the person on whose behalf the system operates, the determination of the time and place of contract formation, and the legal consequences of errors generated by automated systems. By clarifying these matters, the instrument enhances legal certainty while preserving the applicability of general contract law doctrines, including mistake, fraud and misrepresentation.

These clarifications are especially relevant in international trade, where jurisdictional questions and conflict-of-laws issues frequently arise. Determining the time and place of contract formation remains critical for identifying applicable law and competent courts or arbitral tribunals. By providing default rules applicable to automated systems, the Model Law contributes to predictability and reduces the scope for jurisdictional disputes arising from technologically complex transactions.

From an international trade perspective, the UNCITRAL Model Law represents a foundational step towards harmonizing rules governing AI-enabled contracting. However, its effectiveness ultimately depends on national implementation and on its interaction with sector-specific regulations, including those relating to consumer protection, data protection and environmental compliance.

The Model Law's non-binding nature allows States to adapt its provisions to domestic legal traditions, but this flexibility may also result in uneven implementation. Divergent national transpositions could limit harmonization and perpetuate legal fragmentation. Consequently, coordination between trade policy, digital regulation, and environmental governance will be essential to ensure that automated contracting supports sustainable and inclusive international trade.

## **2. Reports and Soft-Law Instruments of International Organizations**

In addition to binding legal instruments, international organizations have increasingly addressed the relationship between artificial intelligence and international trade through reports, guidelines and policy recommendations. The World Trade Organization and the Organization for Economic Co-operation and Development (OECD) have published analytical studies highlighting both the trade-enhancing potential of AI and the regulatory risks associated with its ungoverned deployment.

These initiatives reflect a growing consensus that artificial intelligence is not merely a technological issue, but a structural factor reshaping global trade relations. By mapping AI's impact on productivity, logistics, and market

access, international organizations provide an empirical foundation for regulatory dialogue. Their work also highlights the distributive consequences of AI adoption, particularly the risk that developing economies may be excluded from AI-driven value chains without adequate capacity-building measures.

These reports emphasize the need for transparency, interoperability and international cooperation in AI governance, warning that fragmented regulatory approaches may undermine the efficiency of global value chains. Although such instruments do not create binding legal obligations, they play an important role in shaping regulatory discourse and informing the interpretation of existing trade rules.

Soft-law instruments often serve as precursors to binding regulation by crystallizing shared concerns and policy objectives. In the trade context, they may influence how WTO Members interpret obligations relating to transparency, necessity, and proportionality. Over time, consistent reliance on such standards may contribute to the emergence of common expectations regarding responsible AI governance in international trade.

## **Section 2: The European Union Artificial Intelligence Act and Its Trade Implications**

The European Union Artificial Intelligence Act, adopted in 2024, constitutes the most comprehensive and binding regulatory framework for artificial intelligence to date. It introduces a risk-based approach under which AI systems are categorized according to the level of risk they pose to fundamental rights, safety and public interests.

The EU's risk-based model represents a regulatory shift away from sector-neutral approaches toward differentiated obligations calibrated to potential harm. By embedding fundamental rights considerations into AI governance, the Act aligns technological regulation with broader constitutional values. This approach reflects the EU's long-standing emphasis on precaution and human-centric digital transformation.

Certain AI practices are prohibited outright, while a broad category of "high-risk" AI systems—many of which are relevant to international trade, logistics and border management—are subject to stringent requirements relating to data governance, transparency, human oversight and conformity assessment. These obligations apply not only to EU-based operators, but also to foreign entities whose AI systems are placed on or affect the EU market.

The inclusion of trade-relevant applications within the high-risk category underscores the Act's direct relevance to international commerce. Customs risk assessment systems, biometric border controls, and AI-driven logistics platforms are all subject to heightened scrutiny. This raises compliance challenges for foreign traders and service providers, particularly those operating in jurisdictions with less developed AI governance frameworks.

From an international trade perspective, the extraterritorial reach of the EU AI Act is particularly significant. Companies engaged in cross-border trade with the European Union must ensure that their AI-enabled products and services comply with the Act's requirements, regardless of the location of development or deployment. This effectively exports EU regulatory standards beyond its borders and may influence global regulatory convergence.

This phenomenon of regulatory externalization mirrors earlier EU initiatives in data protection and environmental regulation. While such extraterritorial effects may promote higher global standards, they also raise concerns regarding regulatory sovereignty and unequal compliance burdens. For developing countries, adapting to EU standards may require significant investment in technical and institutional capacity. At the same time, concerns have been raised regarding the potential trade-restrictive effects of the Act, particularly for small and medium-sized enterprises and for firms based in developing countries. Compliance costs and technical requirements may function as de facto barriers to market entry if not accompanied by adequate support and international cooperation.

These concerns highlight the importance of proportionality and international dialogue in AI regulation. Without accompanying measures such as technical assistance, mutual recognition, or transitional arrangements, stringent regulatory requirements may inadvertently undermine the inclusiveness of international trade. This tension reinforces the need for coordination between trade policy and digital regulation.

### **Section 3: The Saudi Arabian Regulatory Approach to Artificial Intelligence**

The Kingdom of Saudi Arabia has adopted an ambitious and strategically integrated approach to artificial intelligence within the framework of Vision 2030. Central to this approach is the National Strategy for Data and Artificial Intelligence, overseen by the Saudi Data and Artificial Intelligence Authority (SDAIA).

Vision 2030 positions artificial intelligence as a driver of economic diversification and global competitiveness. By embedding AI governance within a national development strategy, Saudi Arabia seeks to align regulatory objectives with long-term trade and investment goals. This strategic orientation distinguishes the Saudi approach from purely risk-focused regulatory models.

The Saudi regulatory model emphasizes the development of digital infrastructure, data governance and innovation ecosystems, with a particular focus on sectors such as logistics, smart ports, e-commerce and digital government services. By investing heavily in data centers, cloud computing and AI research, Saudi Arabia aims to position itself as a regional hub for AI-enabled trade and services.

These investments have direct implications for international trade, particularly in maritime logistics and digital commerce. Smart ports and AI-enabled customs procedures can enhance efficiency and reduce transaction costs, strengthening Saudi Arabia's role in global supply chains. At the same time, reliance on advanced technologies necessitates robust legal frameworks governing data use, cybersecurity, and cross-border cooperation.

From a legal perspective, Saudi Arabia's approach combines regulatory guidance, institutional coordination and sector-specific rules rather than a single comprehensive AI statute. This flexibility allows for rapid adaptation to technological change, but also raises questions regarding legal certainty and the protection of rights in cross-border transactions.

The absence of a unified AI law may create interpretative challenges for foreign traders seeking clarity on applicable obligations. However, regulatory flexibility may also facilitate experimentation and innovation. The effectiveness

of this model will depend on the coherence of sectoral regulations and the transparency of enforcement mechanisms.

In the context of international trade, the Saudi model illustrates an emerging trend among Gulf States towards proactive digital regulation aligned with economic diversification strategies. It also provides a useful point of comparison with the more prescriptive regulatory approach adopted by the European Union.

This contrast highlights alternative pathways to AI governance in trade-dependent economies. While the EU emphasizes rights-based risk mitigation, Saudi Arabia prioritizes growth and infrastructure development. Both models offer valuable insights for States seeking to balance competitiveness, regulation, and sustainability.

### **Section 4: Comparative Observations on International and National Frameworks**

A comparative analysis of international and national regulatory approaches reveals both convergence and divergence in the governance of artificial intelligence in international trade.

Instruments such as the UNCITRAL Model Law emphasize functional equivalence and legal certainty in automated transactions, while the EU AI Act prioritizes risk management and fundamental rights protection. Saudi Arabia's strategy, by contrast, focuses on economic transformation and technological leadership, supported by institutional coordination.

These differing priorities reflect broader constitutional, economic, and social contexts.

While convergence may occur around baseline principles such as transparency and accountability, divergence is likely to persist regarding regulatory intensity and enforcement mechanisms. Understanding these differences is essential for managing regulatory friction in international trade.

These differences have important implications for international trade. Divergent regulatory standards may increase compliance costs and legal uncertainty for traders operating across multiple jurisdictions. At the same time, regulatory experimentation at the national and regional levels may contribute to the gradual emergence of best practices and shared norms.

From a systemic perspective, regulatory diversity may function as both a challenge and an opportunity. While fragmentation complicates compliance, it also allows States to test innovative regulatory solutions. Over time, successful approaches may inform international standard-setting and contribute to greater harmonization.

The absence of a binding multilateral framework specifically addressing AI in international trade underscores the continued relevance of national legal systems and regional initiatives. This reality places particular importance on the role of States such as Egypt, which must navigate between multiple regulatory models while safeguarding their strategic interests in global trade—a topic examined in the following part of this study.

For developing and emerging economies, this pluralistic regulatory environment necessitates careful legal and policy calibration. Balancing openness to innovation with regulatory sovereignty and sustainable development objectives will be critical. The Egyptian experience, examined next, offers valuable insights into how national legal systems can engage constructively with evolving global AI governance.

## **PART V: The Egyptian Legal Framework Governing Artificial Intelligence, International Trade and the Green Transition**

Egypt's legal approach to artificial intelligence, international trade, and sustainability reflects a strategy of adaptive reform aligned with national development goals and international obligations. This part examines Egypt's evolving regulatory landscape across six dimensions:

- Section 1 addresses Egypt's institutional and legal efforts to integrate AI within its digital transformation agenda.
- Section 2 analyzes Egypt's data protection framework and its implications for cross-border data governance.
- Section 3 explores trade and maritime regulation as foundational components of Egypt's role in international commerce.
- Section 4 focuses on Egypt's legal initiatives supporting the green transition and sustainable development.
- Section 5 examines Egypt's arbitration framework and its engagement in green trade-related dispute resolution.
- Section 6 provides comparative insights and assesses Egypt's strategic positioning in global trade and technology governance.

### **Section 1: Artificial Intelligence Governance and Digital Transformation in Egypt**

Egypt has adopted a progressive, policy-driven approach to the governance of artificial intelligence within the broader framework of national economic development and digital transformation. The strategic foundation of this approach is Egypt Vision 2030, which identifies digital transformation, innovation and sustainability as central pillars of long-term growth and competitiveness. Within this context, artificial intelligence is viewed not merely as a technological tool, but as an enabler of structural reform across key economic sectors, including trade, logistics and maritime services.

Egypt Vision 2030 reflects a holistic understanding of technological development as a catalyst for economic modernization rather than an isolated regulatory domain. By embedding artificial intelligence within national development planning, Egypt seeks to leverage digital technologies to enhance productivity, improve public services and integrate more effectively into global value chains. This policy orientation is particularly relevant for international trade, where efficiency, transparency and speed increasingly determine competitiveness.

The National Artificial Intelligence Strategy, launched under the supervision of the National Council for Artificial Intelligence, outlines Egypt's objectives in deploying AI across priority sectors such as transportation, ports, customs facilitation and smart infrastructure. The strategy emphasizes capacity building, ethical use of AI, data governance and integration with international best practices. Although the strategy does not constitute binding legislation, it plays an important normative role by guiding regulatory initiatives and public-sector adoption of AI systems relevant to international trade.

As a soft-law instrument, the National AI Strategy functions as a coordinating framework for public institutions and private stakeholders. Its emphasis on ethical principles and international alignment signals Egypt's intention to avoid regulatory isolation while retaining policy autonomy. In the

trade context, this approach facilitates cooperation with foreign partners and international organizations, particularly in areas such as customs digitalization, port automation and smart logistics.

Unlike the European Union, Egypt has not enacted a comprehensive standalone artificial intelligence statute. Instead, AI governance is dispersed across sector-specific laws and regulatory instruments. This flexible approach allows for incremental adaptation to technological developments but also creates challenges in terms of legal coherence and predictability for private actors engaged in cross-border trade.

Egypt is a Party to the Paris Agreement under the UNFCCC. According to the United Nations Treaty Collection, Egypt signed the Paris Agreement on 22 April 2016 and deposited its instrument of ratification on 29 June 2017.

The Agreement accordingly entered into force for Egypt on 29 July 2017 (thirty days after deposit). By contrast, Egypt has not joined the United Nations Convention on International Settlement Agreements Resulting from Mediation (the "Singapore Convention on Mediation").

The Singapore Convention was opened for signature on 7 August 2019, but Egypt is not listed among the States that have signed or ratified it. In fact, commentary on Middle Eastern jurisdictions notes that only Jordan, Qatar and Saudi Arabia had signed the Convention by late 2019, "leaving behind" other countries such as Egypt.

In short, as of the date of this report Egypt has ratified the Paris Agreement (with signature on 22 April 2016 and ratification on 29 June 2017 but has neither signed nor ratified the Singapore Convention on Mediation. This fragmented regulatory landscape places greater reliance on contractual arrangements and administrative guidance to manage AI-related risks. While flexibility may encourage innovation, it may also increase compliance uncertainty for foreign investors and trading partners.

Addressing these challenges may require enhanced inter-agency coordination and the gradual articulation of overarching principles applicable to AI use in trade-related sectors.

### **Section 2: Data Protection and Cross-Border Data Flows under Egyptian Law**

Data governance represents a central legal issue in AI-enabled international trade.

Egypt's primary legislative instrument in this field is the Personal Data Protection Law No. 151 of 2020, which establishes a legal framework for the collection, processing, storage and transfer of personal data. The law applies to both public and private entities and has direct relevance for AI-driven e-commerce platforms, logistics operators and digital trade service providers.

The enactment of the Personal Data Protection Law reflects Egypt's recognition that trust in digital systems is essential for sustainable digital trade. AI applications in international commerce depend heavily on data-intensive processes, making legal certainty regarding data handling a prerequisite for cross-border cooperation. By adopting a comprehensive data protection framework, Egypt signals its commitment to responsible digital governance.

The law introduces core principles of lawful processing, consent, purpose limitation and data security, while also regulating cross-border data transfers. Transfers of personal

data outside Egypt are subject to regulatory approval and must ensure an adequate level of protection. From an international trade perspective, these provisions may affect the deployment of cloud-based AI systems and global supply-chain management tools that rely on transnational data flows.

Such restrictions reflect a balancing act between economic openness and sovereign control over sensitive data. While regulatory approval mechanisms may enhance security and privacy, they may also increase compliance costs for multinational enterprises. The effectiveness of this regime will therefore depend on transparent implementation and regulatory predictability, particularly for trade-dependent sectors.

While the Egyptian data protection regime does not replicate the European Union's General Data Protection Regulation in full, it reflects a growing convergence towards international standards. This alignment facilitates Egypt's integration into digital trade networks while preserving regulatory autonomy in matters of privacy and national security.

Partial convergence with global standards enhances interoperability with foreign regulatory systems and reduces friction in cross-border data exchanges. At the same time, Egypt retains discretion to tailor its regime to national priorities. This calibrated approach supports participation in global digital trade while safeguarding public interests.

### **Section 3: International Trade and Maritime Regulation in the Egyptian Legal System**

Egypt's role as a major maritime State and global trade corridor places maritime law at the center of its international trade framework. The Maritime Trade Law No. 8 of 1990 governs carriage of goods by sea, maritime contracts, liability regimes and port operations. Although enacted prior to the emergence of artificial intelligence and the green transition, the law provides a flexible contractual framework capable of accommodating technological innovation through party autonomy and contractual clauses.

The principle of party autonomy embedded in Egyptian maritime law enables contracting parties to incorporate AI-related provisions addressing automated decision-making, data use and liability allocation. This flexibility is particularly valuable in international shipping contracts, where technological practices evolve faster than legislative reform.

In practice, AI systems are increasingly used in Egyptian ports and logistics hubs for cargo handling, traffic management, customs risk assessment and port scheduling. These developments are supported by administrative reforms aimed at digitizing port services and enhancing trade facilitation, particularly within the Suez Canal Economic Zone.

The deployment of AI in port operations enhances efficiency, reduces congestion and improves risk management. From a trade facilitation perspective, these reforms align with Egypt's obligations under the WTO Trade Facilitation Agreement and strengthen its competitiveness as a maritime and logistics hub.

From an environmental perspective, Egypt's commitments under the Paris Agreement on climate change have begun to influence maritime and trade-related policies. Initiatives aimed at developing green ports, expanding the use of renewable energy in port infrastructure and promoting

energy efficiency in maritime operations reflect the gradual integration of environmental considerations into trade governance.

These initiatives demonstrate how international environmental obligations can shape domestic trade regulation. The integration of climate objectives into maritime policy signals a shift toward sustainable trade governance, aligning economic development with global environmental commitments.

### **Section 4: The Green Transition and Sustainable Trade Initiatives in Egypt**

The green transition has become an increasingly visible component of Egypt's trade and investment policy. National strategies addressing climate change, renewable energy and sustainable development intersect with international trade through projects related to green shipping, clean energy and environmentally friendly logistics.

These intersections illustrate the growing inseparability of trade policy and environmental regulation. Green trade initiatives not only contribute to climate objectives but also create new market opportunities and investment flows, particularly in energy-intensive and transport-related sectors.

Egypt has launched initiatives to modernize port infrastructure by incorporating renewable energy sources, reducing emissions from port operations and adopting smart technologies to optimize resource use. These measures are particularly significant in light of Egypt's geographic position linking Europe, Asia and Africa, and its ambition to position itself as a regional hub for sustainable maritime trade.

Modernized ports equipped with green and digital technologies enhance Egypt's strategic value in global supply chains. Sustainable port development also responds to increasing environmental standards imposed by trading partners and international organizations.

The interaction between AI and environmental sustainability is especially relevant in this context. Intelligent systems capable of monitoring emissions, optimizing vessel movements and managing energy consumption contribute to compliance with international environmental standards while enhancing operational efficiency. However, they also raise questions regarding accountability, data reliability and contractual risk allocation in green trade projects.

Addressing these questions requires careful legal design, including clear contractual clauses and governance mechanisms. As green trade projects become more technologically complex, legal frameworks must evolve to manage technical risk without discouraging innovation.

### **Section 5: Arbitration, Dispute Resolution and Egypt's Position in Green Trade Disputes**

Egypt possesses a well-established legal framework for arbitration and dispute resolution in international trade. Arbitration Law No. 27 of 1994, largely based on the UNCITRAL Model Law, governs both domestic and international arbitration and provides a favorable environment for the recognition and enforcement of arbitral awards. Egypt is also a Contracting Party to the New York Convention on the Recognition and Enforcement of Foreign Arbitral Awards.

This framework enhances Egypt's attractiveness as a venue for resolving international trade disputes. The alignment

with international arbitration standards facilitates confidence among foreign investors and trading partners, particularly in complex, technology-driven transactions.

Although Egypt has not yet acceded to the Singapore Convention on Mediation, mediation is increasingly recognized in practice as a valuable tool for resolving commercial disputes, particularly in infrastructure and investment projects. In the context of AI-enabled and green trade activities, arbitration and mediation offer flexible mechanisms capable of addressing complex technical and regulatory issues.

Mediation's flexibility and confidentiality make it particularly suitable for disputes involving emerging technologies and environmental obligations. Its growing relevance suggests potential benefits in formalizing mediation mechanisms within Egypt's dispute resolution landscape.

The growing number of large-scale infrastructure, logistics and energy projects in Egypt suggests that disputes involving AI systems, environmental obligations and international trade will become more frequent. This trend underscores the importance of developing expertise in green arbitration and of incorporating clear dispute resolution clauses in contracts governing AI-driven and sustainable trade transactions.

Specialized expertise in green and technology-related disputes will be critical to ensuring effective dispute resolution. Contractual foresight, combined with institutional capacity-building, can mitigate legal uncertainty and enhance investor confidence.

#### **Section 6: Comparative Reflections and Egypt's Strategic Position**

When compared with the European Union's comprehensive regulatory approach and Saudi Arabia's strategically coordinated AI governance model, Egypt's framework reflects a pragmatic balance between flexibility and regulatory control. While the absence of a unified AI statute may create uncertainty, Egypt's reliance on policy strategies, data protection legislation and sector-specific regulation allows for adaptive governance aligned with national development priorities.

This pragmatic balance reflects Egypt's developmental context and institutional capacity.

Rather than replicating foreign regulatory models, Egypt adopts a selective and adaptive approach that prioritizes economic integration and technological uptake.

Egypt's strategic maritime location, participation in key international agreements and ongoing digital and environmental reforms position it as a significant actor in the future of AI-enabled and green international trade. Strengthening regulatory coherence, enhancing data governance and expanding engagement with international dispute resolution instruments may further enhance Egypt's role within the evolving global trade system.

Continued engagement with international legal frameworks and best practices will be essential for consolidating Egypt's position. By refining its regulatory architecture and dispute resolution mechanisms, Egypt can contribute meaningfully to shaping inclusive and sustainable AI-enabled global trade.

#### **PART IV: The Green Transition in Maritime Trade, Green Arbitration and Modern Agreements**

The decarbonization of maritime trade is reshaping legal and regulatory frameworks governing international commerce. This part explores the intersection of environmental mandates, technological innovation, and dispute resolution mechanisms within the green transition.

- Section 1 outlines the legal implications of decarbonization measures in global maritime trade.
- Section 2 examines the role of artificial intelligence in enabling compliance and efficiency within green maritime practices.
- Section 3 analyzes green arbitration as a tailored mechanism for resolving sustainability-related trade disputes.
- Section 4 considers the relevance of the Singapore Convention on Mediation in fostering effective and enforceable settlements in green trade contexts.
- Section 5 highlights emerging regulatory trends that complement and shape the future of green maritime governance.

#### **Section 1: The Green Transition in International Maritime Trade**

##### **1. Climate Change Commitments and Maritime Transport**

The green transition has become an integral component of international maritime trade as a result of growing global commitments to climate change mitigation. The adoption of the Paris Agreement in 2015 marked a decisive shift in international economic governance by establishing binding obligations on States to pursue emission-reduction pathways through nationally determined contributions. Although the Agreement primarily addresses State conduct, its effects extend to trade-related sectors that contribute significantly to global greenhouse gas emissions, particularly international shipping.

International shipping, while traditionally excluded from direct national emission targets, has increasingly been recognized as a critical contributor to climate change. The Paris

Agreement's emphasis on economy-wide mitigation has indirectly accelerated regulatory and market pressures on maritime transport. As a result, shipowners, charterers, and logistics operators now operate within a regulatory environment shaped not only by commercial considerations, but also by international climate commitments and sustainability expectations.

In response to these commitments, the International Maritime Organization has adopted a revised strategy aimed at reducing the carbon intensity of international shipping and achieving net-zero greenhouse gas emissions from the sector by around the middle of the twenty-first century. These objectives are being operationalized through technical and operational measures affecting vessel design, fuel choice, speed optimization and emissions reporting.

The IMO strategy translates abstract climate objectives into concrete technical standards and operational obligations. Measures such as the Energy Efficiency Existing Ship Index (EEXI), Carbon Intensity Indicator (CII), and fuel lifecycle assessments increasingly influence vessel competitiveness and chartering decisions. Compliance with these instruments has become a commercial necessity rather than a purely

regulatory obligation, reshaping contractual expectations throughout the maritime supply chain.

For international trade, these developments have profound implications. Compliance with evolving environmental standards increasingly determines market access, contractual obligations and operational costs in maritime transport, thereby reshaping competitive conditions within global trade routes.

Environmental compliance now functions as a market access condition in certain trade routes and ports. Charter parties, carriage contracts, and logistics agreements increasingly incorporate emission-related clauses and performance benchmarks. This evolution reinforces the interdependence between environmental regulation and trade law, as failure to meet sustainability standards may lead to exclusion from key markets or contractual liability.

## **2. Low-Emission Vessels and Green Marine Fuels**

One of the most visible manifestations of the green transition in maritime trade is the development and deployment of low- and zero-emission vessels. Shipping companies and fuel suppliers are investing in alternative marine fuels such as green methanol, green ammonia and hydrogen-based solutions, alongside hybrid and electric propulsion systems.

These technological shifts represent a structural transformation of maritime transport rather than incremental efficiency gains. Investment decisions increasingly depend on regulatory certainty regarding fuel standards, infrastructure availability, and long-term climate policy. Consequently, shipowners face heightened financial and legal risk when committing to specific fuel pathways in an evolving regulatory landscape.

The emergence of green marine fuels has given rise to new categories of commercial contracts, often referred to as green bunker contracts. These contracts typically include detailed provisions on fuel specifications, emission performance, certification requirements, allocation of costs and liability for non-compliance. From a legal perspective, they introduce novel risk factors linked to technological uncertainty, regulatory change and the availability of infrastructure.

Green bunker contracts illustrate the contractualization of environmental compliance.

Parties must address risks associated with fuel quality variability, certification disputes, and changes in regulatory benchmarks. These contracts often require sophisticated risk allocation mechanisms, including adjustment clauses, termination rights, and force majeure provisions tailored to environmental and technological contingencies.

Artificial intelligence plays a supporting role in this transition by optimizing fuel consumption, monitoring performance and facilitating compliance with emission standards. At the same time, reliance on AI-generated data raises questions regarding accuracy, verification and contractual responsibility.

AI-driven monitoring systems increasingly serve as the evidentiary basis for compliance verification and contractual performance assessment. Disputes may arise where AI-generated data conflicts with manual measurements or third-party certification. This reliance on algorithmic outputs underscores the need for clear contractual provisions addressing data validation, audit rights, and liability for erroneous or manipulated data.

## **3. Green Ports and Smart Environmentally Sustainable Ports**

The green transition extends beyond vessels to encompass port infrastructure and operations. Ports are increasingly adopting the concept of green and smart ports by integrating renewable energy sources, electrifying equipment, providing shore-side electricity to berthed vessels and deploying digital systems to manage traffic and emissions.

Port authorities play a critical role in operationalizing sustainability objectives within maritime trade. Investments in electrification and renewable energy reduce emissions at the port level while enabling compliance by vessels. These developments increasingly influence port competitiveness and investment flows in international trade corridors.

AI-enabled technologies are central to these developments. Intelligent systems manage container flows, reduce congestion, optimize berth allocation and minimize waiting times, thereby reducing emissions associated with port operations. Environmental monitoring systems track air quality, noise and waste, supporting compliance with environmental regulations and community standards.

The deployment of AI transforms ports into data-driven logistical hubs. Real-time optimization enhances both environmental performance and economic efficiency. However, it also raises governance challenges related to data ownership, system interoperability, and accountability where AI-driven decisions affect safety, emissions compliance, or contractual performance.

These transformations have significant implications for international trade, as ports function as critical nodes within global supply chains. Green port standards increasingly influence contractual arrangements, investment decisions and the selection of trade routes, reinforcing the link between environmental performance and trade competitiveness.

As sustainability becomes a selection criterion for shipping routes and logistics partnerships, ports that fail to meet environmental benchmarks risk marginalization. Green port certification and compliance increasingly function as trade facilitation tools, aligning environmental performance with commercial advantage.

## **Section 2: Artificial Intelligence as an Enabler of the Green Maritime Transition**

Artificial intelligence occupies a dual position in the context of the green transition in maritime trade. On the one hand, it enhances economic efficiency by reducing costs and improving operational performance. On the other, it serves as a key instrument for achieving environmental objectives in a measurable and verifiable manner.

This dual function positions AI as a bridge between sustainability and profitability. By internalizing environmental objectives into operational decision-making, AI enables compliance without undermining competitiveness. This integration is central to the long-term viability of green maritime trade.

AI systems are used to optimize vessel routes and speeds, reducing fuel consumption while maintaining delivery schedules. They also support predictive maintenance of ships and port equipment, lowering the risk of accidents and environmental harm. In addition, AI-driven monitoring tools facilitate the calculation of carbon footprints at the level of individual voyages, vessels and ports.

These applications enhance both preventive and corrective environmental governance.

Predictive analytics reduce emissions proactively, while detailed carbon accounting supports compliance reporting and contractual verification. Such capabilities are increasingly embedded in charter parties and logistics contracts.

These capabilities are increasingly relevant in light of emerging market-based mechanisms under international climate law, including carbon trading schemes and offset mechanisms. Reliable AI-generated data is essential for the credibility of such mechanisms, yet it also raises questions regarding data integrity, verification and the allocation of responsibility in the event of inaccuracies.

Disputes may arise where financial obligations depend on AI-generated emissions data. Legal frameworks must therefore address verification standards, third-party audits, and liability for inaccurate data submissions. These issues intersect directly with trade law, contract law, and environmental regulation.

### **Section 3: Green Arbitration as a Response to Green Trade Disputes**

#### **1. Concept and Scope of Green Arbitration**

The concept of green arbitration has emerged in response to the growing number of disputes arising from environmentally sustainable projects and green trade activities. It encompasses both procedural and substantive dimensions.

Green arbitration reflects an adaptation of dispute resolution mechanisms to sustainability imperatives. It recognizes that environmental considerations now permeate commercial relationships and must be addressed within arbitration practice itself.

Procedurally, green arbitration seeks to reduce the environmental footprint of dispute resolution by promoting paperless proceedings, virtual or hybrid hearings, limited travel and sustainable case management practices. Substantively, it refers to the resolution of disputes involving environmental obligations, renewable energy projects, green fuels and sustainable infrastructure.

Procedural sustainability enhances legitimacy while reducing costs. Substantively, green arbitration requires arbitrators to engage with environmental norms, technical standards, and evolving regulatory frameworks, expanding the traditional scope of commercial arbitration.

In the context of maritime trade, green arbitration increasingly addresses disputes arising from green bunker contracts, port development projects and compliance with environmental standards. Arbitrators are therefore required to engage with environmental law principles and technical standards alongside traditional commercial law doctrines.

This interdisciplinary complexity necessitates specialized expertise. Arbitrators must assess regulatory change, technological uncertainty, and environmental compliance alongside contractual interpretation, reinforcing the importance of expert evidence and tailored procedural rules.

#### **2. Green Arbitration and Climate Change Norms**

While the Paris Agreement does not establish a specific arbitration mechanism for climate-related disputes, it provides an important normative framework that informs the interpretation of contractual obligations and regulatory measures. Arbitral tribunals increasingly refer to climate

commitments and sustainability objectives when assessing the reasonableness of regulatory change, force majeure claims and risk allocation in long-term contracts.

Climate commitments influence expectations of regulatory stability and foreseeability. Tribunals increasingly view environmental regulation as a foreseeable component of the legal environment, limiting the success of claims based on regulatory change or hardship.

This trend reflects a broader integration of environmental considerations into international dispute resolution and reinforces the relevance of green arbitration as a forum capable of addressing complex, multi-dimensional disputes arising from the green transition.

Green arbitration thus functions as a bridge between commercial certainty and environmental accountability, aligning dispute resolution practices with sustainable development objectives.

### **Section 4: The Singapore Convention on Mediation and Sustainable Trade Disputes**

The United Nations Convention on International Settlement Agreements Resulting from Mediation, commonly known as the Singapore Convention on Mediation, establishes a unified framework for the recognition and enforcement of international mediated settlement agreements. It plays a role analogous to that of the New York Convention in the field of arbitration.

By enhancing enforceability, the Convention elevates mediation from a voluntary process to a reliable dispute resolution mechanism in international trade. This is particularly valuable for disputes involving emerging technologies and sustainability obligations.

The Convention is particularly relevant to disputes arising from AI-enabled and green trade activities. Mediation offers a flexible and collaborative approach to resolving disputes involving technological uncertainty and evolving regulatory frameworks. By ensuring the enforceability of mediated settlements across borders, the Convention enhances legal certainty while reducing the financial and environmental costs associated with prolonged arbitration or litigation.

Mediation allows parties to adapt solutions dynamically, preserving commercial relationships while accommodating regulatory change. Its alignment with sustainability principles makes it especially suitable for green trade disputes.

Hybrid dispute resolution mechanisms, such as arb-med-arb, combine the advantages of mediation and arbitration and are increasingly used in complex trade and infrastructure disputes. These mechanisms align closely with the objectives of sustainable development by promoting efficient and environmentally responsible dispute resolution.

Hybrid mechanisms offer procedural flexibility while preserving enforceability. Their growing use reflects a pragmatic response to the complexity of green and AI-enabled trade disputes.

### **Section 5: Complementary Regulatory Trends Affecting Green Maritime Trade**

Beyond the Paris Agreement and the Singapore Convention, several additional regulatory developments influence the green transition in maritime trade. These include the inclusion of shipping in the European Union Emissions Trading System, the adoption of fuel standards under

European maritime regulations and the development of green shipping corridors between cooperating ports and States.

These initiatives demonstrate the emergence of multi-level environmental governance affecting maritime trade. Compliance increasingly depends on coordinated action across jurisdictions, reinforcing the need for regulatory alignment and mutual recognition.

Collectively, these initiatives reshape the legal and commercial environment of international maritime trade. They require traders, shipowners and port operators to integrate environmental compliance into contractual arrangements and operational planning, thereby reinforcing the interdependence of trade law, environmental law and technological governance.

The green transition thus transforms environmental compliance from a peripheral concern into a core component of trade governance. Legal frameworks must adapt accordingly, ensuring coherence between commercial certainty, technological innovation, and environmental sustainability.

## Conclusion

This study has examined the legal implications of artificial intelligence and the green transition for international trade through an integrated analysis of international, regional and national legal frameworks. It has demonstrated that artificial intelligence has evolved from a supporting digital tool into a structural component of contemporary international trade, influencing contract formation, logistics management, maritime operations, digital services and cross-border data flows. At the same time, the global commitment to environmental sustainability, crystallized in the Paris Agreement and reinforced by sector-specific initiatives in maritime transport, has introduced a new layer of legal obligations that increasingly shape trade relations.

The analysis has shown that the traditional framework of international trade law, particularly the agreements of the World Trade Organization, was not designed to address the challenges posed by AI-driven decision-making and environmentally conditioned trade. Issues such as liability for automated decisions, algorithmic transparency, data governance and the integration of emission-reduction obligations into commercial transactions remain only partially regulated at the multilateral level. While existing WTO principles retain their relevance, they are insufficient on their own to ensure legal certainty and fairness in a digital and green trading environment.

Recent regulatory developments offer important, albeit fragmented, responses to these challenges. At the international level, the UNCITRAL Model Law on Automated Contracting provides a foundational framework for recognizing AI-enabled contract formation and performance. At the regional level, the European Union Artificial Intelligence Act introduces a comprehensive risk-based regulatory model with significant extraterritorial effects on international trade. In parallel, the Kingdom of Saudi Arabia has adopted a strategically coordinated approach to artificial intelligence governance within the broader context of economic diversification and smart logistics under Vision 2030.

The study has further highlighted the growing importance of national legal frameworks in shaping the practical operation of AI-enabled and green trade. In this regard, Egypt

occupies a distinctive position. Through its National Artificial Intelligence Strategy, data protection legislation, maritime trade law and environmental commitments under the Paris Agreement, Egypt has laid the foundations for integrating digital transformation and sustainability into its international trade regime. However, the absence of a unified legal framework governing artificial intelligence and the green transition presents challenges in terms of coherence, predictability and investor confidence.

The green transition in maritime trade has emerged as a defining feature of contemporary international commerce. The shift towards low-emission vessels, green marine fuels and smart environmentally sustainable ports has transformed contractual practices and risk allocation in maritime trade. Artificial intelligence plays a critical enabling role in this transformation by optimizing energy use, monitoring emissions and supporting compliance with evolving environmental standards. At the same time, these developments have increased the likelihood of disputes arising from regulatory change, technological uncertainty and environmental performance obligations.

In this context, the study has identified green arbitration and mediation as essential components of the evolving dispute resolution landscape. Green arbitration responds to both the procedural and substantive dimensions of sustainability, while the Singapore Convention on Mediation enhances the enforceability of mediated settlements in cross-border commercial disputes. Together, these mechanisms offer flexible and sustainable solutions for resolving disputes arising from AI-enabled and environmentally sustainable trade activities.

## Result

- Artificial intelligence is testing the limits of WTO trade rules. The core WTO agreements (GATT, GATS, TFA), drafted before the AI era, are being strained by AI-driven commerce. AI blurs traditional distinctions between goods and services and enables automated, cross-jurisdictional transactions, raising doubts about whether existing trade disciplines adequately cover these novel practices. Even though WTO rules are intended to be technology-neutral, national AI-related measures (such as data localization requirements or algorithm export controls) risk contravening most-favored-nation and national treatment principles if they disproportionately restrict foreign digital service providers or function as disguised trade barriers.
- AI regulation poses challenges to WTO transparency and due process. The increasing use of algorithmic decision-making in customs, trade logistics and regulatory enforcement is undermining the WTO's transparency obligations and procedural fairness norms. Many AI systems operate as "black boxes," so when authorities use them for risk assessments or compliance decisions, traders often cannot discern the reasoning behind adverse decisions or effectively challenge them. This opacity erodes the predictability and reviewability that international trade law requires, prompting calls to interpret WTO transparency rules as demanding algorithmic accountability – i.e. disclosure of AI logic and outputs to affected parties.

- Current WTO rules lack specific provisions for AI, leading to a regulatory gap. No binding multilateral rules yet address AI-driven trade, and discussions have been confined to soft-law fora like the WTO Work Programme on E-Commerce. This absence of updated rules is resulting in unilateral and regional regulatory initiatives that diverge: some countries champion free data flows and minimal AI regulation, while others prioritize digital sovereignty and strict oversight, reflecting a growing divide. Without multilateral harmonization, such divergence risks regulatory fragmentation, undermining the uniformity and legal certainty that the WTO system is meant to provide for global traders.
- The green transition is reshaping international trade frameworks by integrating sustainability as a core obligation. Global climate commitments (e.g. the Paris Agreement) now drive trade-related regulation, as seen in sectors like maritime transport where the International Maritime Organization imposes carbon reduction standards on shipping. Environmental standards and climate-friendly requirements have effectively become market access conditions: for instance, compliance with emissions targets and use of green technologies are increasingly written into charter parties, cargo contracts, and port regulations. This normative shift means trade governance must reconcile environmental protection mandates with fundamental WTO principles of non-discrimination and proportionality, rather than treating sustainability measures as mere exceptions.
- Multi-level environmental measures are emerging, requiring coordination across trade regimes. New regulatory initiatives at regional and bilateral levels are greening trade rules beyond the WTO's purview – for example, the European Union's extension of its Emissions Trading Scheme to international shipping, the adoption of strict green fuel standards for vessels, and the creation of "green shipping corridor" agreements between certain ports and states. These developments exemplify a multi-layered governance of sustainable trade, where compliance depends on aligned action by multiple jurisdictions. To prevent inconsistent requirements and trade barriers, there is a pressing need for regulatory alignment and mutual recognition among nations, ensuring that environmental trade measures coalesce into a coherent global framework rather than a patchwork of conflicting rules.
- The European Union's AI regime illustrates the extraterritorial impact of AI regulation on trade. The EU's 2024 Artificial Intelligence Act establishes a comprehensive, risk-based legal framework that imposes strict obligations (on transparency, safety, and human oversight) for "high-risk" AI systems, including those used in international trade contexts like supply chain logistics, customs inspections and biometric border control. Notably, these rules apply not only to EU companies but also to any non-EU operators whose AI systems are placed on or affect the EU market, effectively exporting EU regulatory standards abroad. While this extraterritorial reach may elevate AI governance standards globally, it also raises questions of national regulatory sovereignty and places heavy compliance burdens on foreign firms – particularly businesses in developing countries or SMEs – which risk becoming de facto barriers to trade absent support and international cooperation.
- Saudi Arabia's approach balances ambitious AI integration with flexible regulation. Under its Vision 2030 strategy, Saudi Arabia views AI as a driver of economic diversification and trade competitiveness, implementing a National Strategy for Data and AI through the Saudi Data & AI Authority (SDAIA). Rather than enacting a single comprehensive AI law, Saudi regulators have opted for sector-specific rules and large investments in digital infrastructure (e.g. smart ports, e-commerce platforms and cloud services) to position the Kingdom as a regional hub for AI-enabled trade. This decentralized approach, coordinated at the policy level, allows rapid adaptation to technological change and encourages innovation, but the lack of a unified AI statute can create uncertainty for foreign traders seeking clear, consistent legal obligations in Saudi markets.
- Egypt's legal framework exemplifies an adaptive, development-oriented approach to AI and green trade. Instead of a dedicated AI act, Egypt employs a mix of national strategies and targeted laws to govern AI in trade, aligning with its Egypt Vision 2030 goals of digital transformation and sustainable growth. The government has established a National AI Strategy (overseen by a specialized council) and introduced new legislation like the Personal Data Protection Law, while updating sectoral laws (such as maritime and trade laws) to address AI usage and environmental compliance within existing legal structures. This pragmatic model – relying on policy guidance, data governance rules, and incremental legal reforms – allows flexibility and local innovation without wholesale adoption of foreign regulatory models, though it requires careful coordination to maintain legal certainty and fulfill Egypt's international trade obligations as these technologies evolve.
- "Green arbitration" is emerging as a specialized method for resolving trade disputes in the sustainability era. Arbitral practice is adapting both procedurally and substantively to address disputes involving environmental obligations and green trade projects. Procedurally, green arbitration minimizes the environmental footprint of dispute resolution (for example, by using paperless filings, virtual hearings and other eco-friendly measures), and substantively it deals with conflicts over issues like renewable energy contracts, carbon-neutral transport, or climate regulations – requiring arbitrators to apply environmental norms, technical standards, and climate policy in addition to traditional commercial law. This expansion of scope demands that arbitrators possess specialized expertise across both trade and environmental law, ensuring that complex disputes involving AI systems or green obligations are resolved with due regard to scientific evidence and sustainability goals.

- Green arbitration aligns dispute resolution with climate commitments and sustainable development. Arbitral tribunals have begun to treat climate change regulations and international environmental commitments as integral to the legal context of trade disputes, rather than external factors. In practice, this means that when companies challenge government measures or contract changes citing burdens from new green policies, arbitrators increasingly view robust climate regulations as foreseeable and justified, limiting claims of unfair surprise or breach of legitimate expectations. Over time, this trend is cementing the role of green arbitration as a bridge between commercial certainty and environmental accountability – tribunals now consciously interpret trade contracts and regulatory measures in light of climate objectives, so that dispute outcomes remain compatible with Paris Agreement goals and broader sustainability principles.

## Recommendations

### 1. Recommendations at the International Level

International organizations should take further steps to integrate artificial intelligence and the green transition into the multilateral trade framework. The World Trade Organization should explicitly address AI-driven trade and environmental sustainability within its Work Program on Electronic Commerce and consider the development of dedicated disciplines on digital and green trade. Greater coordination between the WTO, UNCITRAL and environmental bodies would contribute to regulatory coherence and legal certainty.

The International Maritime Organization should continue to harmonize technical and legal standards governing low-emission vessels and green marine fuels, while strengthening monitoring, reporting and verification mechanisms to support market-based climate measures.

### 2. Recommendations at the National Legislative Level

States should adopt clear and coherent legal frameworks governing the use of artificial intelligence in sectors directly connected to international trade, including logistics, maritime transport, customs facilitation and digital commerce. Such frameworks should address liability, transparency, data protection and human oversight, while remaining adaptable to technological change.

Environmental and emission-reduction obligations should be expressly incorporated into international commercial and maritime contracts, with clear provisions on risk allocation, cost sharing and remedies in cases of non-compliance.

### 3. Recommendations Specific to Egypt

Egypt should consider consolidating its AI-related regulatory landscape by developing a comprehensive legal framework or guiding principles governing artificial intelligence in trade-related sectors, building on existing strategies and legislation. Enhancing regulatory clarity would strengthen investor confidence and facilitate Egypt's integration into digital and green trade networks.

Further investment in green port infrastructure and AI-enabled logistics within the Suez Canal Economic Zone would reinforce Egypt's strategic position as a sustainable

maritime hub linking Europe, Asia and Africa. Egypt may also benefit from expanding its engagement with international dispute resolution instruments, including consideration of accession to the Singapore Convention on Mediation.

### 4. Recommendations on Dispute Resolution

Arbitral institutions and practitioners should promote green arbitration practices and integrate sustainability considerations into procedural rules and case management techniques. Parties to AI-enabled and green trade contracts should be encouraged to include multi-tier dispute resolution clauses combining mediation and arbitration, thereby enhancing efficiency and enforceability while reducing environmental impact.

### 5. Recommendations for Legal Scholarship

Further comparative research is needed on the interaction between artificial intelligence, international trade law and environmental regulation, particularly from the perspective of developing and emerging economies. Greater attention should be devoted to the contractual and dispute resolution aspects of green maritime trade, including the evolving practice of green bunker contracts and AI-based environmental compliance systems.

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