# Strengthening Supply Chains through Efficiency, Resilience, AI and Environmental Performance

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# Preface

International trade has been a powerful driver of economic growth and higher living standards around the world. However, the global trading system has come under increasing pressure in recent years from global shocks, supply chain disruptions and geopolitical uncertainty. Countries will need to work together to make the global trading system fairer and function better while preserving the benefits of open markets and rules-based global trade, and navigating structural transformations in our economies.

This report looks at two such transformations that are reshaping international supply chains, bringing both opportunities and challenges. The rapid development of artificial intelligence (AI) has significant potential to optimise supply chain operations and logistics but can also present risks that must be carefully managed – including data protection and cybersecurity. In parallel, policies to advance the green transformation can help reduce carbon emissions and tackle pollution while enhancing energy security, but to be fully effective they may require more detailed information at the border on how products are produced, transported, and certified.

Effective and coherent policies on trade facilitation are key to navigating these transformations. Streamlined, AI-enabled border procedures can support resilient supply chains by keeping goods moving more efficiently, including during crises, and by providing firms with the flexibility needed to diversify their suppliers and markets. Secure, standardised, and machine-readable data, together with interoperable systems, can help integrate new environment-related requirements while minimising bottlenecks at the border.

The 2025 Asia Pacific Economic Cooperation (APEC) Leaders' Gyeongju Declaration reaffirmed the importance of AI for international trade, as well as the need to promote more environmentally sustainable trade. In close partnership with Korea, the OECD provided evidence and analysis to support APEC discussions.

Building on these developments at APEC 2025, this report brings together the OECD's work on creating a supportive policy environment for trade facilitation and paperless trade. It highlights the links between supply chain efficiency, resilience and environmental performance, and the role of digitalisation in strengthening these outcomes. The work significantly benefits from insights drawn from Korea's rapid progress and policy efforts to deploy AI tools at the border and beyond.

Going forward, the OECD will continue to provide our objective, evidence-based analysis to support policymakers in seizing the full potential of digital and AI-enabled trade facilitation for stronger, more sustainable growth in the years ahead.

Mathias Cormann
Secretary-General, OECD

Han-Koo Yeo
Trade Minister of Korea

# Foreword

Global supply chains have undergone profound transformation in recent years, driven, among other factors, by the emergence of artificial intelligence (AI) and rising environment-related requirements. *Strengthening Supply Chains through Efficiency, Resilience, AI and Environmental Performance* explores how AI, digital tools and trade facilitation policies can enhance efficiency and resilience, while helping firms and governments respond to evolving environmental demands.

During Korea's hosting of APEC in 2025, to which the OECD contributed through its analytical work, APEC member economies underscored the potential of AI in international trade and the importance of environmentally sustainable trade. This report builds on that engagement. Notably, the report draws key insights from Korea's experience of adopting AI and broader digital technologies for streamlining processes at the border, as well as its long-term investment in the core building blocks of a paperless trading environment.

The report is structured as follows. Chapter 1 reviews how two key drivers – the rapid development of AI and environmental requirements – are shaping global supply chains, emphasising their shared relevance to a digital backbone. Chapter 2 explores how AI is transforming international trade, in particular how AI-enabled tools, including advanced data analytics and automation, can enhance trade facilitation. Chapter 3 outlines the core enabling building blocks for leveraging AI in trade facilitation, examining barriers affecting digital services, the regulatory environment underpinning electronic transactions, and measures affecting cross-border data flows, complemented by the insights from Korea's deployment of AI tools at the border. Chapter 4 examines the implications of emerging environmental requirements, highlighting the growing demand for granular environmental performance data and traceability across sectors. Chapter 5 discusses how technical interoperability, and international co-operation can support with the implementation of environmental requirements while minimising border frictions. Finally, Chapter 6 concludes with areas for policy action to build an enabling environment to fully reap the benefits of going paperless.

# Acknowledgements

The report *Strengthening Supply Chains through Efficiency, Resilience, AI and Environmental Performance* was co-ordinated by John Drummond, under the general oversight of Marion Jansen. The main authors of the report are Sang Hyun Park, Sebastian Weber, Javier Lopez Gonzalez, Silvia Sorescu and Gil Yong Um.

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Caitlin Boros and Hilary Gaboriau managed the text production of the report and edited the manuscript.

The content of this publication draws on outputs prepared under the aegis of the OECD Trade Committee and benefits from the efforts of delegates in verifying and commenting on the databases and publications that form the evidence base for this work.

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# Key messages

- **Artificial Intelligence (AI) and environmental requirements are transforming global trade, and supply chains must adapt to keep pace:** While multiple forces are reshaping global supply chains, two stand out for their systemic impact: (i) the rapid uptake of AI and advanced analytics, including for trade facilitation, and (ii) the rise in environmental requirements linked to market access. Adapting to these changes requires a common response that places greater emphasis on digital tools, trusted data, and technical interoperability.
- **Trade facilitation underpins supply chain resilience and efficiency:** By streamlining procedures, enabling risk-based controls, and supporting diversification of suppliers and markets, trade facilitation helps firms anticipate and respond to shocks more effectively, making supply chains more resilient. These impacts are amplified when combined with digitalisation and AI, which improve transparency, traceability, and risk management.
- **Prerequisites for progress:** Reaping the benefits of AI for trade facilitation requires having a functioning paperless business landscape with interoperability at its core. AI can only be scaled up in border settings when documents and processes are digitised, data elements are standardised, and systems interoperate – with legal certainty for electronic transactions and secure cross-border data exchange. Without these preconditions, AI cannot reliably automate classification, link documents, or support predictive risk analysis. Furthermore, access to AI-enabling goods and services, skilled personnel, and data – together with domestic governance frameworks and international co-operation – determines whether border agencies can deploy AI effectively and at scale. Economies that have invested over time in digital infrastructure and data standards are better positioned to integrate AI into routine border operations.
- **Environmental requirements are bringing new data and verification needs across supply chains:** As measures expand on products' environmental performance, firms and authorities must produce, exchange, and verify granular information – often across jurisdictions and at borders. If not smoothly embedded in existing trade facilitation systems, these obligations risk duplicating checks, increasing costs, and disrupting border clearance.
- **Dual purpose digital tools:** Tools such as Single Windows, processing trade-related information in advance, and data platforms that support AI-enabled facilitation can help speed up customs procedures while also handling environmental information, such as related certificates or product-level information. This allows border agencies to carry out the necessary checks without creating separate processes, helping maintain efficiency while supporting compliance.
- **Interoperability is the critical bottleneck – and solution:** *Regulatory interoperability* (alignment/recognition of *what* information is required) and *technical interoperability* (standards and interfaces for *how* it moves) are both essential. Closing interoperability gaps allows data to be reused, verified and trusted across borders, reducing burdens – especially for SMEs – and maintaining predictability in clearance.
- **Border agency co-operation is pivotal:** Co-ordinated border management – domestically and internationally – enables shared risk indicators, joint access to trusted registries, and consistent procedures so that AI deployment and enforcement of environmental-related measures can be integrated without creating parallel, duplicative processes.
- **Country experiences offer important lessons about what works:** Where core building blocks for end-to-end digitalised trade processes are advanced – such as digitised documents, streamlined procedures, data standards, and enabling regulation in the case of Korea – AI tools

(e.g., risk profiling, X ray analytics, harmonized system (HS) code prediction, certificate checks, document linking, robotic process automation and supply chain intelligence) can be deployed in an integrated manner at the border, strengthening both efficiency and resilience.

- **Enhanced international co-operation can play a key role:** Further dialogue in trade agreements, regional and multilateral fora can support technical interoperability. This can then contribute to the deployment of emerging digital tools such as AI for trade facilitation as well as for more efficient, resilient and environmentally performing supply chains.

# Executive summary

Global supply chains are being reshaped by two systemic forces – the rapid uptake of artificial intelligence (AI) and analytics for facilitating safe trade, and a growing wave of environmental requirements linked to market access. These developments are unfolding in an increasingly complex global trade landscape, with important implications for how supply chains operate.

The report *Strengthening Supply Chains Through Efficiency, Resilience, AI and Environmental Performance* builds on the Organisation for Economic Co-operation and Development's (OECD) previous work on the policy environment for paperless trade and AI, as well as OECD core databases such as the Trade Facilitation Indicators (TFIs), Digital Services Trade Restrictiveness Index (Digital STRI) and the Index for Digital Trade Integration and Openness (INDIGO). It explores the core building blocks of an enabling environment supporting an effective adoption of AI and broader digital tools for streamlining border processes, which play a pivotal role in improving altogether the resilience, efficiency and environmental performance of supply chains.

**Reaping AI benefits in trade facilitation requires building blocks for an operational paperless landscape with interoperability at its core.**

At the operational level, digitising trade-related documents into machine-readable formats underpins the application of AI to core tasks, alongside the broader digitalisation of border procedures through systems such as single windows enabling domestic and cross-border co-operation. The integration of complementary technologies, such as big data and distributed ledger systems, can further streamline operations. These technical foundations depend on supportive legal frameworks for electronic transactions and secure cross-border data flows, while interoperability requires overall adherence to international standards for the movement and processing of data and documentation.

**The broader trade policy environment needs be conducive to the adoption and diffusion of AI.**

The adoption and diffusion of AI for trade facilitation depends on the availability and cross-border movement of key inputs, including AI goods and services, skilled workers, and data. Trade policy plays a central role in determining whether customs and other border agencies can access and deploy AI at scale. For instance, tariffs on information and communication technology (ICT) hardware can increase the cost of physical infrastructure, while restrictions on computer and telecommunications services hinder access to digital inputs such as cloud computing services. Furthermore, as cross-border data flows are the lifeblood of AI, stringent restrictions on data transfers can hamper the aggregation of diverse datasets required for training AI models.

**Evolving environmental requirements bring complex new data, traceability, and verification needs across supply chains.**

Notifications of environmental-related technical requirements to the World Trade Organization are on the rise, and the OECD's Inclusive Forum on Carbon Mitigation Approaches (IFCMA) Climate Policy Database currently documents 1 600 individual policy instruments across 38 economies. In complying with such diverse measures where these may be enforced at the border, firms operating across several jurisdictions

can face challenges in dealing with divergent data formats, reporting templates, and verification channels. The burden can be heavier for smaller firms and firms operating in lower income economies, which often lack resources, technical capacity, and digital tools. Limited guidance on how environmental requirements interface with border processes adds further costs, creating operational complexity, duplicating verification, and risking bottlenecks that can undermine trade facilitation efficiency.

**Co-ordinated border management, regulatory and technical interoperability are essential to seamlessly integrate new environmental requirements.**

Integrating environmental requirements-related data into border processes requires co-ordination across various actors, including firms, customs administrations, environmental regulatory agencies, accredited verification bodies, and digital system providers. At the core of this effort is the need for both regulatory interoperability (the alignment or mutual recognition of required information) and technical interoperability (standards and interfaces governing how such data moves). Trade facilitation frameworks and emerging technologies, including AI, can offer practical solutions. By adapting existing systems such as Single Windows for trade or risk management systems, environmental-related attributes can be more seamlessly integrated into border workflows without creating duplicative processes.

**Korea's experience showcases how an effective digital ecosystem can enable swift deployment of AI technologies in supply chains.**

Building on robust investment in paperless trade facilitation and digital infrastructure, the Korea Customs Service transitioned to AI-driven customs procedure management. This includes applying AI-driven risk profiling, automated X-ray screening to detect illicit goods, and document classification automation. By strengthening the core building blocks of end-to-end digitalised trade processes, Korea has established a policy environment conducive to advanced AI use, demonstrating how they can create the conditions for AI-driven efficiency across supply chains.

**Navigating the AI transition and growing environmental requirements along supply chains requires policy actions in key areas.**

AI and evolving environmental requirements are two drivers reshaping global supply chains through a shared dependence on digital tools and trusted data. To build an enabling ecosystem, these developments point altogether to several priority areas for policy action:

- *Advancing interoperability*, through common data models, interoperable registries and certification systems, and integration of environmental data into existing trade facilitation architectures.
- *Enhancing supply chain resilience*, by embedding environment-related and compliance information into border processes and digital tools for trade facilitation while preserving predictability and efficiency.
- *Investing in enabling ecosystems*, including digital infrastructure, legal recognition of electronic transactions, and institutional capacity across border agencies. AI can only be scaled up in border settings when documents and processes are digitised, data elements are standardised, and systems interoperate – with legal certainty for electronic transactions and secure cross border data exchange.
- *Promoting mechanisms for inter-agency co-ordination*, ensuring operational co-operation between customs, environmental authorities, and other regulators to enable the use of emerging technologies such as AI and support coherent implementation of new requirements enforced at the border.
- *Enhancing international co-operation*, including as regards the layers underpinning technical interoperability: the alignment of underlying data elements required, the standardisation of relevant documents, and the compatibility of data systems that enable information to flow reliably between domestic agencies and across borders.

# 1 Introduction: Two key drivers shaping global supply chains, one digital backbone

In recent years, global supply chains have been disrupted by major shocks, from the COVID-19 pandemic to geopolitical tensions, revealing vulnerabilities in how goods move across borders and how firms manage risk. At the same time, supply chains have become more concentrated, amplifying the impact of shocks: the share of import-concentrated goods has risen by 50% from the late 1990s to the early 2020s. As a result, resilience has become an economic necessity. Resilient supply chains are not those without risk, but those able to anticipate, absorb, and adapt to shocks – an ability increasingly dependent on digital tools that enhance visibility, agility, and responsiveness (OECD, 2025[1]).

Within this evolving landscape, supply chains are being shaped by a range of forces, among which two stand out for their growing influence. The first is the rapid development of artificial intelligence (AI) and other advanced analytics that are transforming how information is processed and how decisions are made, including across logistics and border operations. The second is the growing wave of environmental requirements (Deconinck, Jansen and Barisone, 2023[2]), which entail that firms need to collect, verify, and transmit detailed information about how products are produced, transported, and certified. Although these forces arise from different policy and technological domains, they converge increasingly at the border, where goods, data, and compliance obligations intersect.

In navigating both disruption and transformation, trade facilitation plays a pivotal role. Effective border procedures – whether through streamlined documentation, risk-based controls, or co-ordinated inspections – help maintain the steady flow of goods even in times of crisis, as demonstrated during the pandemic (OECD, 2020[3]). Trade facilitation also enables firms to diversify suppliers and markets, supporting resilience by lowering trade costs and increasing operational flexibility. These same mechanisms are becoming essential as border agencies and firms confront the growing data and compliance demands created by both AI-enabled processes and new environmental regulations.

Crucially, the ability of trade facilitation frameworks to respond to these drivers depends on the strength of a shared digital foundation. AI can only enhance risk management, document processing, or targeting when the underlying data are digitised, standardised, and machine-readable. Similarly, environmental requirements – such as those concerning emissions reporting, compliance with deforestation requirements, or other traceability measures – can only be implemented cost efficiently when information can travel effectively and securely along the supply chain and across borders requiring the underlying data on environmental performance to be standardised and digitised so that it is machine-readable. In both cases, digital tools, trusted data, and technical interoperability form the backbone that enables border processes to scale and adapt.

Reflecting these shared requirements, this report links the efficiency and environmental sustainability agendas through a unified digital lens. The first part (Chapters 2 and 3) explores how AI and digitalisation

are transforming international trade and border management, focusing on how AI-enabled capabilities – such as analytics, automation, and decision support – can strengthen trade facilitation functions. This includes a special focus on the case of Korea in using emerging technologies such as AI for trade facilitation. The second part (Chapters 4 and 5) examines the implications of emerging environmental requirements for border operations and end-to-end digitalised trade processes (*going paperless*), and highlights the role of digital tools, data integrity, and interoperability in supporting compliance while minimising disruptions. Together, the two parts illustrate how a common digital infrastructure can help supply chains advance efficiency, resilience and environmental performance objectives. Chapter 6 concludes and provides policy observations.

# 2 The role of AI powered trade facilitation for supply chain efficiency and resilience

AI is becoming increasingly central to how international trade functions. As AI technology is rapidly advancing, it is reshaping the way goods are moved, transactions are processed, and supply chain operations are managed. AI technologies underpin logistics optimisation, predictive analytics, and real-time visibility, enabling firms to anticipate disruptions and allocate resources more efficiently. Yet AI's ability to enhance trade depends heavily on the digital maturity of border and supply chain processes: without structured, machine-readable data, interoperable border management related systems, and integrated digital platforms, AI cannot deliver meaningful gains in customs or logistics operations.

These advances have important implications for trade facilitation. At the border, AI can significantly strengthen core functions such as risk profiling, targeting, anomaly detection, document processing, and the verification of harmonized system (HS) codes and certificates. Combined with robotics, IoT devices, and automation systems, AI can improve the accuracy and speed of inspections while reducing manual workloads. Beyond the border, AI can enhance transparency, traceability, and risk management across entire supply chains – extending the benefits of trade facilitation into upstream production and downstream distribution. When embedded in digital, interoperable systems, AI amplifies the ability of traders and authorities to manage growing complexities and respond to supply chain disruptions.

## 2.1. AI is transforming trade

Data, AI services, and the goods that enable AI technologies are increasingly traded across borders. There are three defining features of this evolving landscape in terms of what we trade today (Ferencz, López González and Oliván García, 2022[4]). First, trade in AI-enabled goods, including "smart products" combining the characteristics of goods and services, high-performance computing hardware, data centre infrastructure, and connectivity equipment (WTO, 2025[5]). Second, cross-border trade in AI services, including generative AI, is expanding. Third, cross-border data flows are rising fast, driven by the need to train, retrain and fine-tune AI models and enable real-time inference (Sun and Trefler, 2023[6]).

At the same time, AI technologies are transforming supply chain management by improving inventory control, demand forecasting, and logistics optimisation. For example, recent studies find that companies that adopted AI-driven supply chain solutions have achieved significant reduction in logistics costs (Cohen and Tang, 2024[7]). AI can also enhance supply chain visibility by detecting patterns and anomalies across vast datasets from multiple sources to track shipments and anticipate disruptions more accurately and efficiently (McKinsey & Company, 2025[8]). But, beyond supply chain management, AI also stands to revolutionise trade facilitation.

## 2.2. AI can revolutionise trade facilitation

Emerging digital technologies – including AI, big data analytics, and distributed ledger systems – are reshaping customs operations and the wider ecosystem of border management. These technologies are increasingly embedded in how customs administrations analyse trade flows, assess financial and tax information, and detect irregularities.

AI systems, in particular, have the potential to:

- **Support more sophisticated risk segmentation and anomaly detection** by drawing on large volumes of data sources (Vijayakumar, 2025[9]), allowing risk profiles to be refined more effectively than with rule-based systems alone;
- **Enable machine learning models to rapidly identify patterns** associated with non-compliance or illicit activity (World Customs Organization, 2025[10]), enabling the detection of fraud and other high-risk behaviours across large transactions;
- **Improve the consistency and timeliness of operational choices** through automated decision support tools, allowing border officers to focus on other tasks (Outram and Swartz, 2026[11]); and
- Beyond risk management, AI systems can **contribute to the automation of key processes**, from document verification and data matching to the integrity checks required for certificates and authorisations (Anderson, Belcineanu and Tzvetkova, 2025[12]).

Together, these innovations can enhance operational efficiency, strengthen the quality of controls, and improve the overall performance and predictability of border procedures.

However, the effective use of AI for trade facilitation is not automatic and depends on two fundamental enabling conditions.

First, border processes must be sufficiently digitalised, enabling the transition to digital customs and allowing trade facilitation to *go paperless* (OECD, 2025[13]) (Mikuriya, 2016[13]). AI systems rely on structured, machine-readable, and interoperable data, which can only be generated and exchanged efficiently when documents, procedures, and information flows have been digitised across the supply chain. Without this foundation, AI cannot support automation, predictive modelling, or reliable risk analysis.

Second, the broader trade policy landscape must be conducive to the adoption and diffusion of AI technologies. This includes ensuring access to AI-enabling goods and digital services, maintaining open and trusted cross-border data flows, enabling the movement of skilled personnel, and establishing governance frameworks that provide legal certainty for electronic transactions (Ferencz, López González and Oliván García, 2022[4]). When these conditions are in place, countries are better positioned to harness AI as a tool for more effective, agile, and transparent trade facilitation.

These dimensions are discussed in greater detail below.

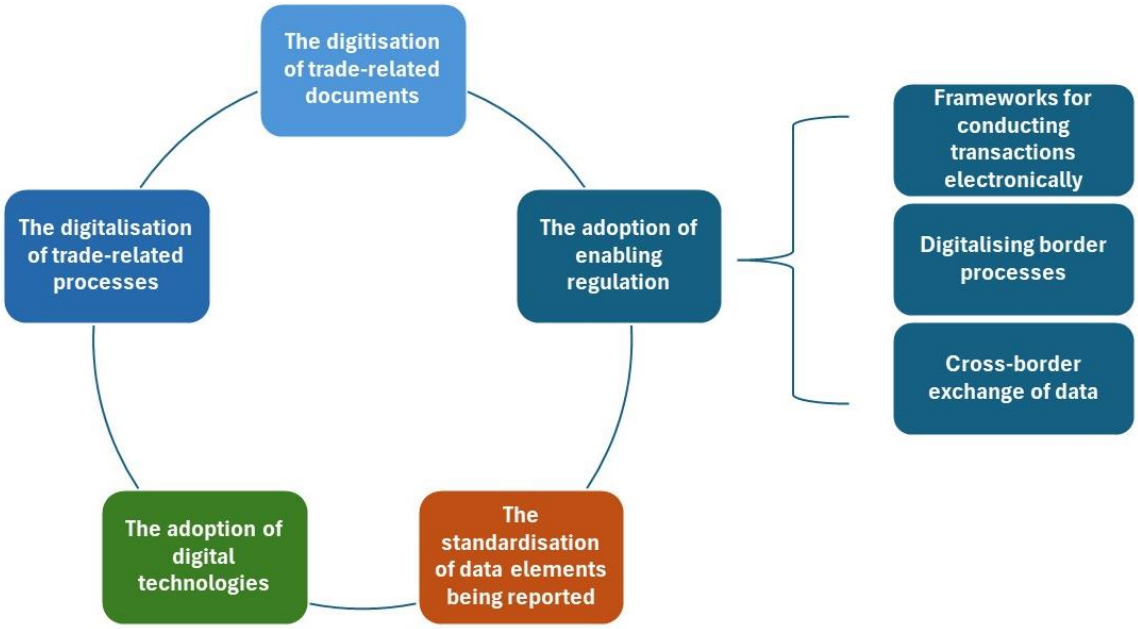
### *2.2.1. Going paperless is an essential pre-condition to reap the full benefits of AI*

AI systems rely on complete, high-quality, and trustworthy digital inputs. Paperless trade – built on digital documents, standardised data formats, and interoperable processing systems – provides the essential infrastructure on which AI can function effectively. Without these foundations, AI cannot automate classification tasks, link documents across different stages of a transaction, or generate predictive insights that support supply chain decision-making. Digitalisation of trade facilitation frameworks must also be backed by robust legal and regulatory frameworks: frameworks for electronic transactions, e-authentication, e-signatures, and cross-border data exchange all help create the certainty needed for the seamless movement and use of digital information (OECD, 2025[14]). Even with such systems in place, however, effective AI adoption depends on broader policy conditions, including access to AI-enabling technologies,

data, skilled personnel, and supportive governance arrangements. These elements determine whether border agencies and supply chain actors can deploy AI tools at scale and with confidence.

Realising the full potential of AI and other advanced digital technologies in trade facilitation also requires readiness across the entire supply chain. AI can only deliver efficiency gains when all actors involved – from traders and logistics service providers to customs administrations and other border agencies – operate within a digital environment that supports paperless processes (OECD, 2025[14]). This means that digitalisation must extend across every stage of the transaction, from the creation of commercial documents to the submission of regulatory information and the processing of clearances. Ensuring that the core building blocks for *going paperless* are in place (Figure 2.1) – digitised documents, streamlined procedures, common data standards, and interoperable information systems – is essential. Only when these components function effectively and cohesively can AI enhance the speed, accuracy, and resilience of border operations.

## Figure 2.1. The building blocks for *going paperless:* A conceptual framework




Source: (OECD, 2025[14]).

**The digitisation of trade-related documents**, such as invoices, bills of lading or customs declarations is critical. Fragmented and analogue processes prevent AI from being applied to core tasks such as automated document processing or risk assessment. **The digitalisation of border procedures** is another requirement. For example, digitalised pre-arrival processing[1] or digital Single Window systems[2] are important pre-conditions for the adoption of AI in trade facilitation systems. A systematic digital procedure that enables domestic and cross-border agency co-operation can also address the technical interoperability challenges which prevent the actors along the supply chains to exchange risk intelligence and compliance data.

**The standardisation of data elements**, through the adoption of international standards, such as the UN Trade Data Element Directory (UNTDED/ISO7372), the "buy-ship-pay" data model, the Supply Chain Reference Data Model, and document presentation standards for e-invoicing or e-sanitary and phytosanitary certificates, is essential for establishing interoperability with foreign customs systems and facilitating the development of machine-readable document formats. Finally, **the adoption of supportive legal frameworks** provides the basis for recognising electronic transactions, governing digital border

processes, and allowing trusted data to move across borders. Establishing legal certainty and infrastructure for e-signatures, e-authentication, and secure cross-border data flows is critical in creating digital ecosystem required for AI to function effectively.

However, the deployment of AI in trade facilitation is not without challenges including in the context of AI governance, and particularly regarding trust, accountability, and the ethical use of technology across the supply chain. As emphasised by the OECD AI Principles (OECD, 2024[15]) transparency and explainability enable people to understand how an AI system is developed, how it operates, and how it arrives at specific outcomes, allowing users of AI systems to make informed choices. In the context of paperless trade, a lack of transparency and explainability can, for example, create concerns about how decisions on risk profiling or private-sector logistics optimisation are made.

Maintaining a *human in the loop* is important to ensure accountability allowing human agents to validate AI generated insights and handle edge cases or contextual nuances that automated systems may misinterpret. The mitigation of bias in data also remains a concern for *going paperless* with AI. AI models trained on historical trade data risk consolidating existing biases, such as historical bias or selection bias, which can lead to the discriminatory targeting of specific traders, regions, or goods.

### *2.2.2. The trade policy landscape also needs to be conducive to the adoption and diffusion of AI*

The adoption and diffusion of AI for trade facilitation depends critically on the availability and cross-border movement of key inputs, including AI-enabling goods and services, skilled workers, and data. Trade policy, together with the domestic and international policy environment underpinning AI adoption and diffusion, plays a central role in determining whether customs and other border agencies can access and deploy AI at scale.

The AI-enabling trade policy environment has six layers (Figure 2.2 – see (Ferencz, López González and Oliván García, 2022[4])).

First, **access to AI goods**. Tariffs and non-tariff measures on information and communication technology (ICT) hardware, such as advanced semiconductors and sensors can affect access, increasing the cost of the physical infrastructure underpinning AI.

Second, **access to digital services underlie the ability to connect and operate AI systems**. Restrictions to critical services, like computer and telecommunications services, can hinder access to digital inputs, including the AI technologies themselves but also cloud computing. They can also raise the costs of connectivity infrastructure on which AI systems operate (Aaronson, 2024[16]).

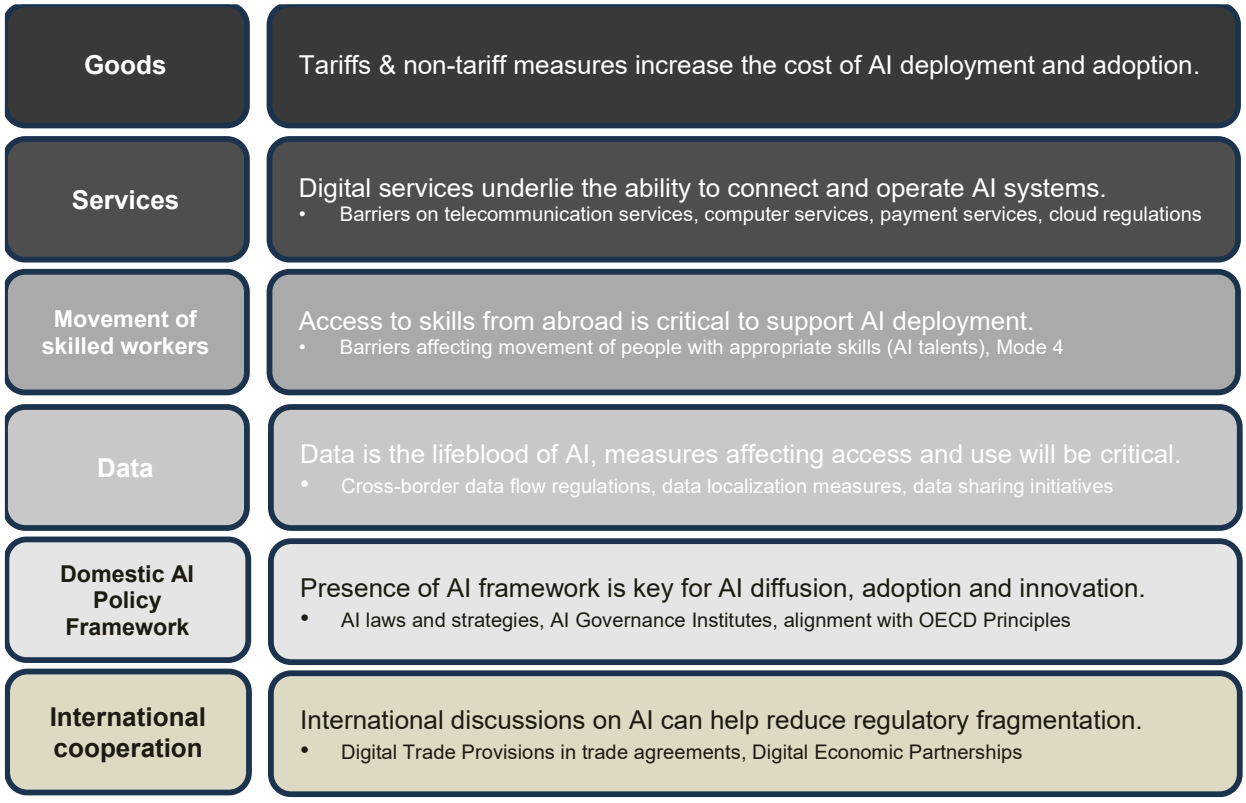
Third, AI relies heavily on **human capital** with specialised AI expertise (Goldfarb and Trefler, 2018[17]). Since AI expertise is concentrated, domestic policies affecting the mobility of skilled workers across borders can have a significant impact on a country's ability to attract the talent needed for developing and adopting AI systems, including at the border.

Fourth, **cross-border data flows**. These are the lifeblood of AI. Stringent restrictions on cross-border data transfers and localisation requirements can hamper the aggregation of diverse datasets required for training, retraining, and fine-tuning AI models, as well as for enabling real-time inference.

Fifth, a **domestic AI policy framework**. These include national AI strategies, legal frameworks, and well-defined institutional arrangements for AI governance. They provide clear policy direction and greater certainty for AI service providers.

Sixth, **international co-operation**. This includes increased international discussions on issues relevant to AI, in regional trade agreements and digital economy partnerships, but also in wider fora such as the United Nations, Asia-Pacific Economic Cooperation (APEC)[3] or the OECD.

## Figure 2.2. Trade policy plays a central role in enabling the adoption and diffusion of artificial intelligence




Source: based on (Ferencz, López González and Oliván García, 2022[4]).

In addition to *going paperless* and the trade policy conditions that enable access to, and use of, AI tools, the effective deployment of AI at the border also depends on building the capabilities of customs and other border agencies to integrate AI into day-to-day operations. This calls for targeted training and upskilling so staff can interpret AI outputs, understand limitations and potential biases, and exercise informed human oversight. Continuous learning and change management are particularly important to ensure that AI complements existing risk management workflows, strengthens compliance, and supports consistent decision making across agencies.

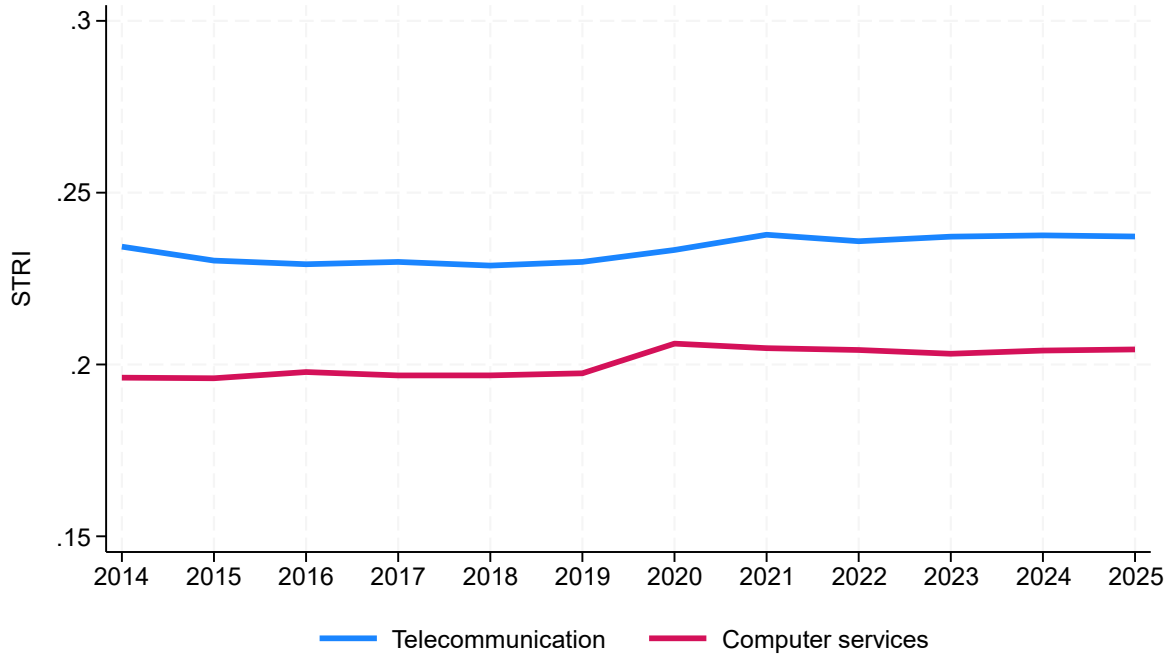
# 3 The enabling environment for AI in trade facilitation

A critical requirement for deploying AI systems is to ensure end-to-end digitalisation across the entire supply chain, involving all relevant actors. In this context, the enabling environment for AI in trade facilitation is critical and requires a set of mutually reinforcing conditions across the digital, regulatory, and policy landscape. Since AI systems depend on reliable digital inputs and seamless data flows, economies need an ecosystem that supports the availability of digital services, the legal certainty of electronic transactions, and the consistent digitalisation of border procedures. At the same time, AI adoption relies on the ability to move data securely across borders, supported by interoperable systems and trusted governance frameworks. International co-operation is equally essential to prevent fragmentation, align standards, and ensure that digital infrastructure and data practices remain compatible across jurisdictions. These elements form altogether the foundation that allows AI to be deployed effectively and to realise its potential in strengthening and modernising trade facilitation.

## 3.1. Barriers affecting digital services

Access to AI capabilities is increasingly taking place through cross-border delivery of AI services, including access to models, inference capacity, and managed AI platforms, which rely on cloud computing and high-capacity digital infrastructure. Therefore, the adoption and diffusion of AI technologies at the border and along global supply chains depend critically on the openness of the digital services sectors that support them, in particular computer (encompassing software development, data processing, and database management) and telecommunication services (internet connectivity required for AI systems). The OECD Services Trade Restrictiveness Index (STRI) 2025 data highlights that these sectors continue to face significant barriers, which can hinder the broader deployment of AI solutions. The average STRI for the computer services sector (across 51 countries) has increased by 4.1% from 2014 to 2025, while the STRI for the telecommunications sector has increased by 1.2% over the same period (Figure 3.1).

### Figure 3.1. Barriers in telecommunication and computer services remain high



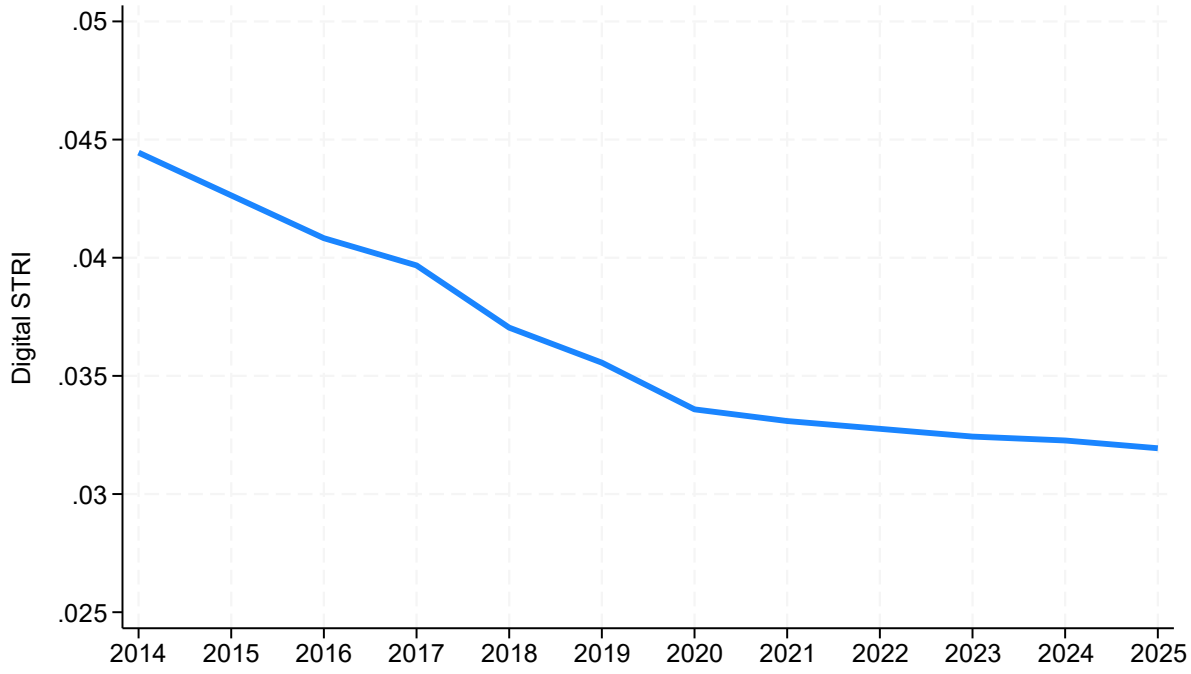

Note: The OECD Services Trade Restrictiveness Index (STRI) takes values between 0 and 1, with 1 being the highest level of restrictiveness. The figure includes data for 51 economies.
Source: OECD STRI database, 2026.

## 3.2. The regulatory environment underpinning electronic transactions

AI systems for trade facilitation require a supportive regulatory environment for digital transactions. AI tools do not exist as stand-alone applications but are built on underlying e-transaction and e-payment systems, which enable AI to process digital transaction records, including payment confirmation and verification. The OECD Digital STRI highlights that, at the global level, while regulatory frameworks for e-transactions are becoming more supportive, barriers affecting electronic payments are increasing, offsetting some of the efficiency and resilience gains that AI can deliver (Figure 3.2 and Figure 3.3).

**Figure 3.2. The regulatory environment has become more supportive to electronic transactions**

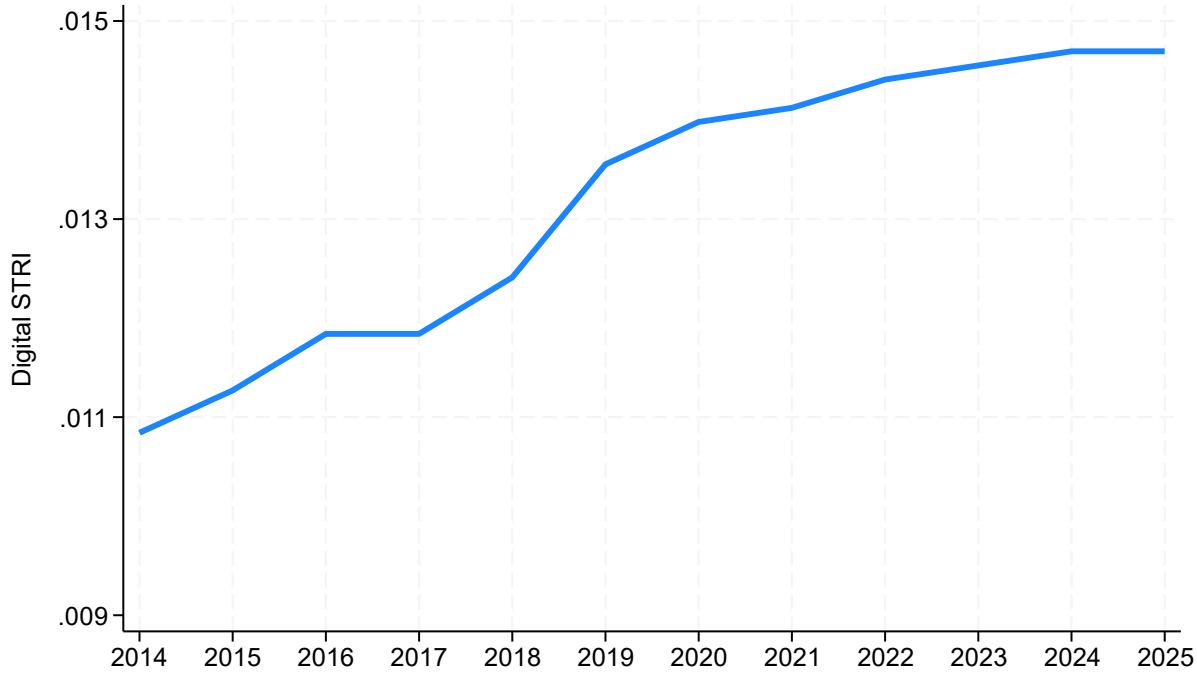
Digital Services Trade Restrictiveness Index (STRI) in electronic transactions




Note: The OECD Digital STRI takes values between 0 and 1, with 1 being the highest level of restrictiveness. The figure includes data for 129 economies.
Source: OECD Digital STRI database, 2026.

### Figure 3.3. Barriers affecting electronic payments and infrastructure and connectivity are increasing

Digital Services Trade Restrictiveness Index (STRI) in electronic payments




Note: The OECD Digital STRI takes values between 0 and 1, with 1 being the highest level of restrictiveness. The figure includes data for 129 economies.
Source: OECD Digital STRI Database, 2026.

## 3.3. Digitalisation of border processes

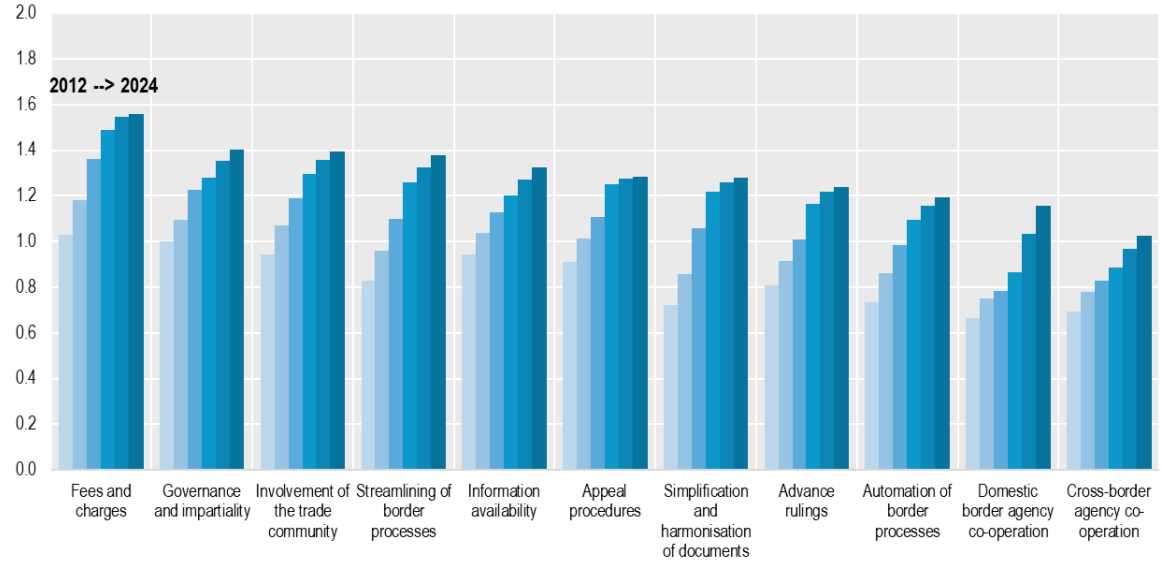
The automation of border processes predates the recent wave of advanced AI technologies and has traditionally been one of the most challenging are of trade facilitation (Figure 3.4). Improvements in automation have been driven by the gradual introduction of tools such as automated pre-arrival processing, automated risk management, electronic payments of duties and charges, and digital Single Windows for trade (OECD, 2025[14]).

A key reason for this is that automation is difficult to implement without prior simplification of documentary requirements and streamlining of processes. While countries have made progress in simplifying documentation through alignment with international standards and documentary requirements reviews (Figure 3.4), the benefit is yet to fully translate into equivalent gains in automation. Where traditional automation has not been able to advance, gains from the deployment of AI tools will be hard to materialise.

Progress in streamlining border processes has also decelerated in recent years. This largely reflects challenges in the operational implementation of tools such as Authorised Operators (AOs), post-clearance audits and Single Windows, as well as the still low coverage in practice of transactions by pre-arrival processing and simplification of release from clearance.

## Figure 3.4. Automation of border processes and border agency co-operation are among the most challenging trade facilitation policy areas

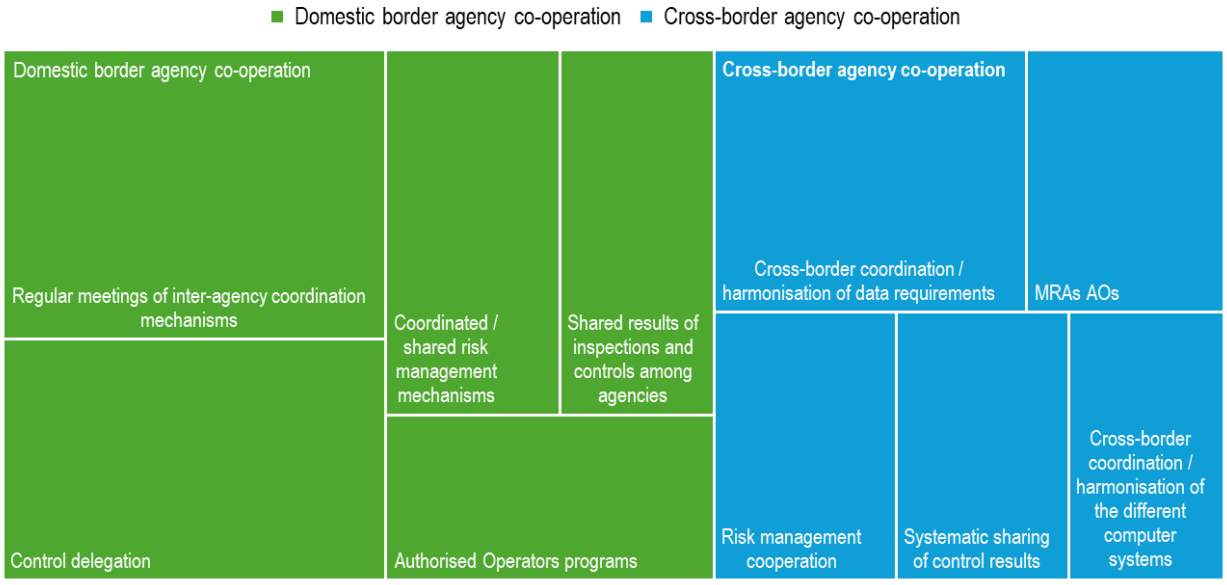
2 = maximum performance that can be achieved by area, 2012-24




Note: The figure shows the global average by area between 2012 and 2024.
Source: OECD Trade Facilitation Indicators (TFIs) database, 2025 (https://sim.oecd.org/default.ashx?ds=TFI).

Domestic and cross-border agency co-operation are the top areas of progress, yet remain the hardest to further improve (Figure 3.4). Economies worldwide scaled up investments in domestic border agency co-operation since the COVID-19 pandemic, when flexible arrangements helped adapt border processes and facilitate trade in selected goods. Ongoing supply chain disruptions and shifting trade patterns have increased the need to formalise previously informal or sector-specific taskforces. This is reflected, first, in stronger institutional mechanisms for domestic inter-agency co-ordination, including the establishment of permanent technical secretariats, the expansion of participating agencies, and more regular meetings to set strategy and oversee implementation, with proceedings increasingly made public (though with varying levels of detail). Second, regulatory frameworks have advanced to enable a wider set of agencies to delegate controls to another authority involved in cross-border management, particularly Customs, and to facilitate intelligence sharing to improve risk management efficiency and support certified trader programmes (Authorised Operators, AOs). In parallel, cross-border agency co-operation is increasingly driven by strengthened co-ordination mechanisms between Customs administrations, including initiatives to align data requirements and improve interoperability between IT systems (OECD, 2025[18]) (Figure 3.5).

### Figure 3.5. Institutional and regulatory frameworks together with risk management and digitalisation measures are driving improvements in border agency co-operation



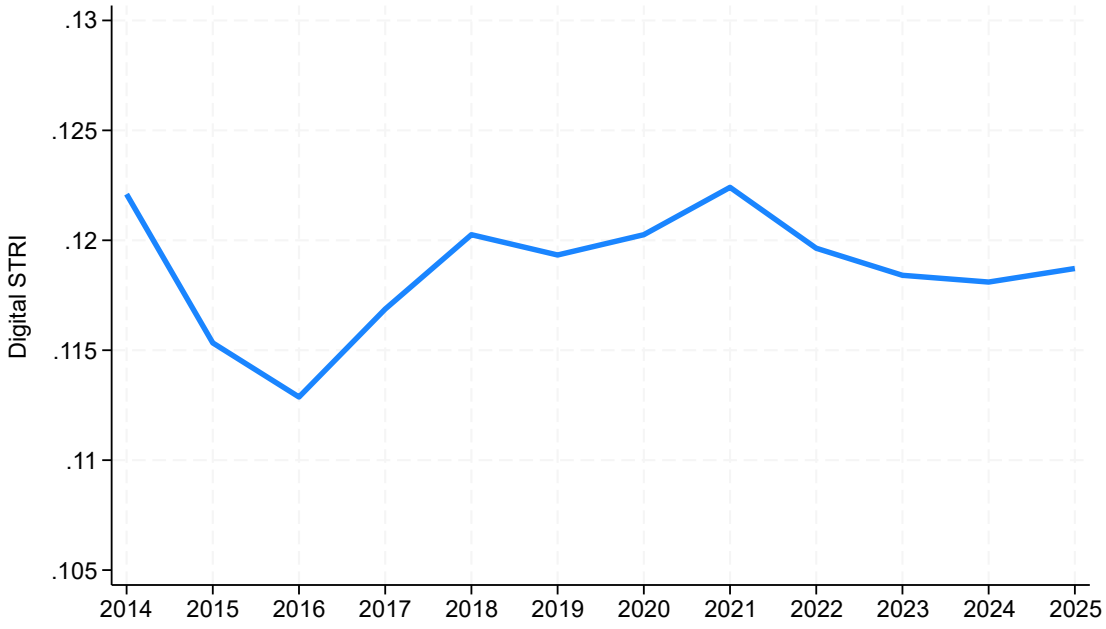

Note: The size of the individual squares highlights the contribution of the showcased measures to the improvement in the areas of domestic and cross-border agency co-operation, respectively.
Source: OECD Trade Facilitation Indicators (TFIs) database, 2025 (https://sim.oecd.org/default.ashx?ds=TFI).

## 3.4. Measures affecting cross-border data flows

The use of AI in optimising supply chains is also closely linked to the digital exchange of trade-related documents and the digitalisation of processes. The Digital STRI data shows that restrictions affecting interconnection and connectivity have remained high over time (Figure 3.6). These barriers to cross-border data flows can add challenges to maximising the potential of AI tools deployed for trade facilitation along supply chains.

### Figure 3.6. Restrictions on data flows remain high

Digital Services Trade Restrictiveness Index (STRI) in infrastructure and connectivity



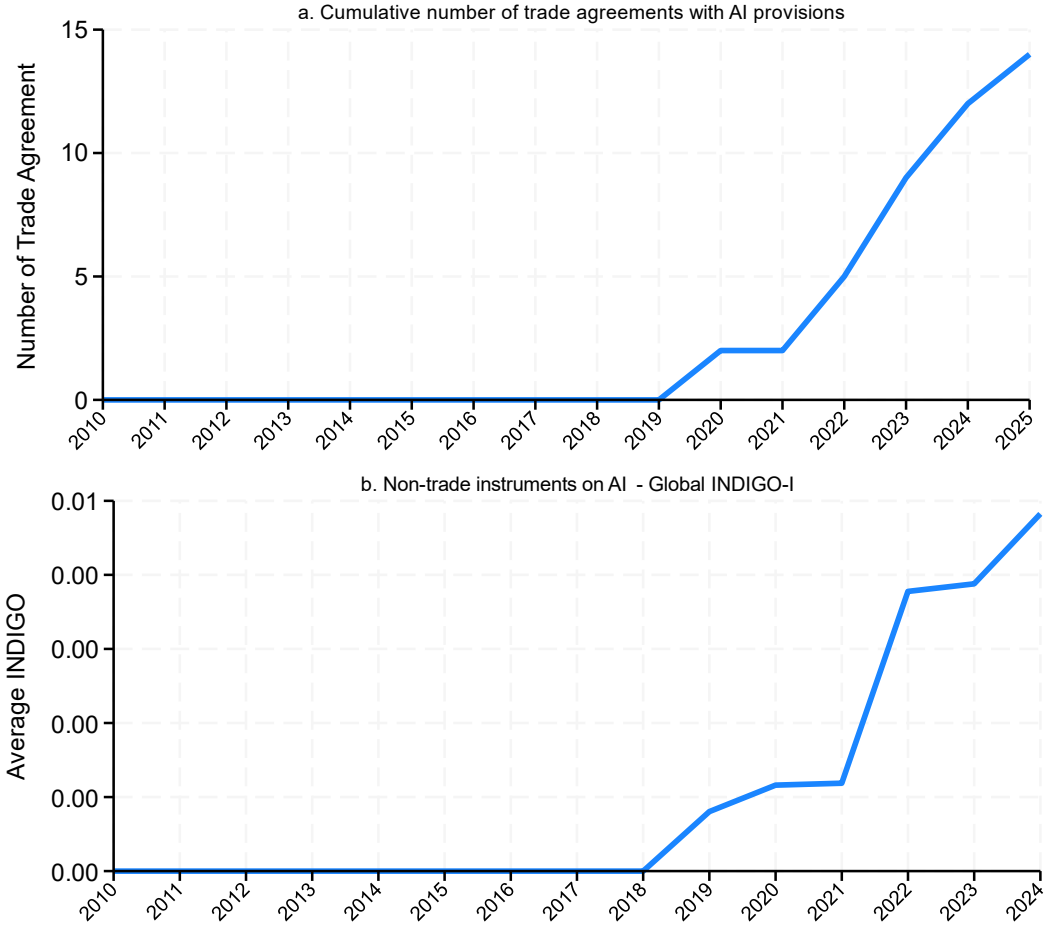

Note: The OECD Digital STRI takes values between 0 and 1, with 1 being the highest level of restrictiveness. The figure includes data for 129 economies.
Source: OECD Digital STRI database, 2026.

## 3.5. The role of international co-operation

Fragmented approaches to AI governance across countries can hinder AI adoption and diffusion. International discussions are therefore critical for bridging gaps in AI policy frameworks and for ensuring that domestic AI policies do not become unnecessary barriers to trade. Aligning standards and domestic policy frameworks around trustworthy AI can help create a more predictable global trade policy environment (Ferencz, López González and Oliván García, 2022[4]).

As global discussions on digital trade have expanded rapidly in recent years, there is particularly strong momentum in international dialogue on AI, through both trade agreements and non-trade instruments (Figure 3.7). The cumulative number of trade agreements, including bilateral and regional trade agreements with AI-related provisions has increased from zero to 14 over the past six years. The OECD Index of Digital Trade Integration Openness (INDIGO), which monitors digital trade policies and openness, additionally captures the growing intensity of international co-operation on AI, signalling that governments are increasingly engaging in trade agreements and multilateral fora to foster interoperable AI frameworks (OECD, 2025[19]).

## Figure 3.7. International discussions on artificial intelligence (AI) are growing




Note: The method underlying OECD Index of Digital Trade Integration and Openness (INDIGO) is described in (OECD, 2025[19]). For any given year, a country will score full points, 1, in its INDIGO if it has fully binding agreements or hard commitments across all areas in "enabling e-commerce" with all partner countries. It will score zero if it has no agreement with any country. This bilateral method of aggregation enables capturing both the depth and the spread of digital trade discussions.
Source: Cumulative number of trade agreements with AI provisions is from (Burri, Callo-Müller and Kugler, 2025[20]). Data on non-trade instruments on AI (Global INDIGO-i) is from OECD INDIGO Database.

## 3.6. From digital to AI-enabled trade facilitation and resilient supply chains: The case of Korea

The case of Korea Customs Service (KCS) shows how digital tools, data standardisation, and interoperable border systems can enable rapid, integrated deployment of AI applications and resilient supply chains – from X-ray threat detection to automated document linking and predictive risk analysis. Korea's experience illustrates that AI effectiveness depends on the strength of the underlying digital ecosystem and the interoperability of systems across agencies.

KCS' efforts towards digitalisation and AI adoption show how effective digital ecosystem can enable the swift deployment of advanced AI technologies at the border as well as behind- and beyond-the-border. Faced with a more than threefold increase in cross-border e-commerce transactions between 2015 and 2025,[4] KCS transitioned to AI-driven customs procedure management. This shift is built on decades of digitalisation with its electronic clearance and trade systems at the centre.

Applications of AI technologies across various stages of the trade process not only promote the efficiency of cross-border goods movement but also enhance resilience across global supply chains.

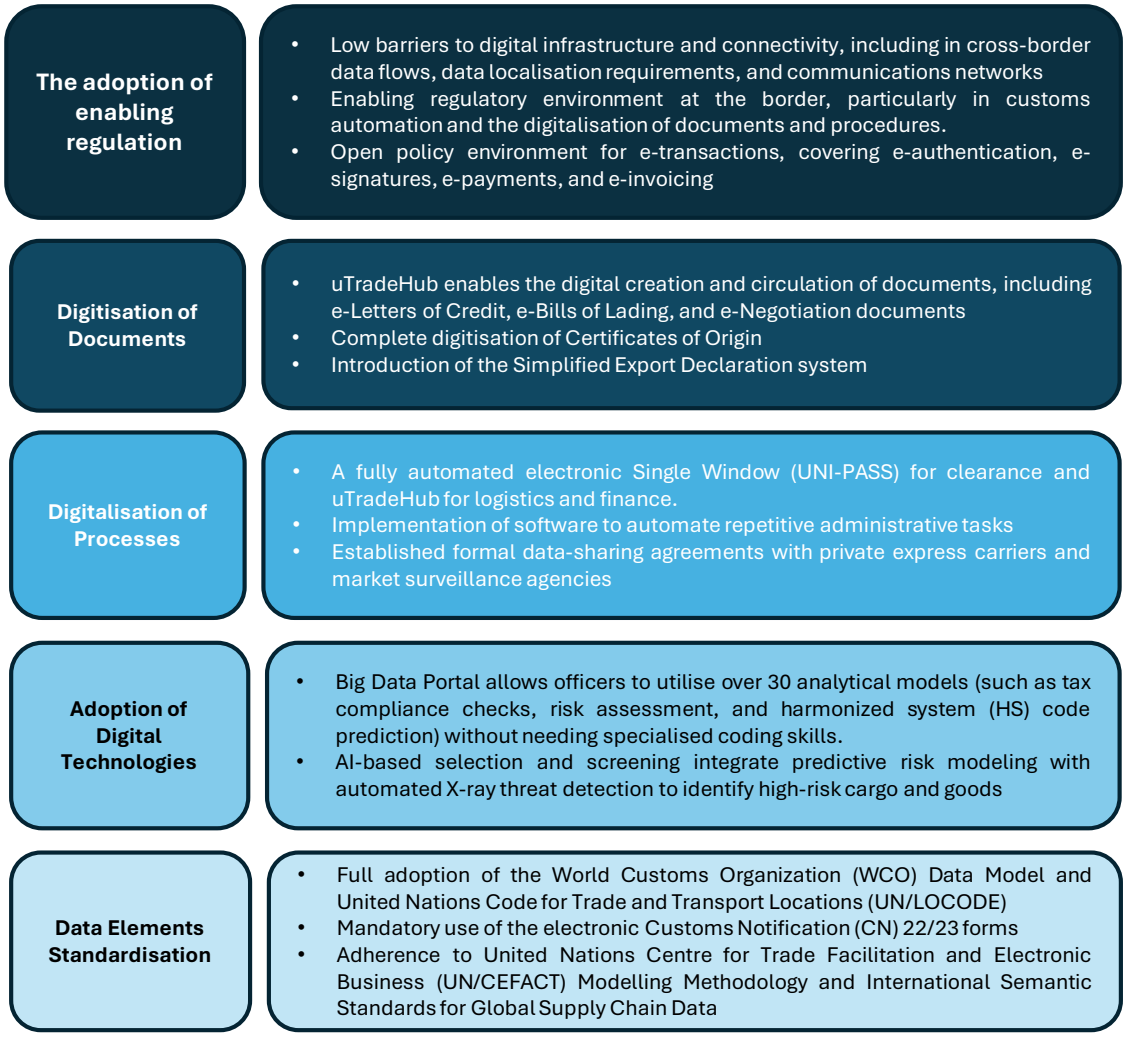
- Korea Customs uses **AI-driven risk profiling and tax-compliance risk modelling** to more accurately identify high-risk cargo, passengers, and traders across the clearance process.
- AI **X-ray screening, import price and transshipment route analysis** strengthens inspection accuracy and efficiency, helping detect illicit goods, undervaluation and abnormal logistics patterns.
- **Document and classification automation**, including HS code prediction, certificate of origin authenticity checks, and linking unstructured documents and data reduces manual workload and improves consistency in procedures at the border.
- **Robotic Process Automation** streamlines internal operations by automating repetitive tasks such as data extraction, trade statistics processing, and audit planning reporting.
- **AI-driven intelligence tools**, including company profiling, analysis of unusual trade patterns, and vessel route visualisation strengthen supply-chain transparency and resilience.

These AI applications operate as integrated services within Korea's trade facilitation ecosystem, rather than as isolated pilots, and part of KCS's efforts towards end-to-end digitalised trade processes, encompassing the full range of actors and trade-related documents across the entire supply chain. Using the lens of the *going paperless* conceptual framework (see (OECD, 2025[14]) and (Figure 2.1)), KCS' approach is summarised below, with Figure 3.8 illustrating where Korea's policy efforts are positioned within this framework:

- **The adoption of enabling regulation:** Korea has established a legal framework for *going paperless*, significantly lowering barriers to e-transactions and cross-border data exchange over the past decade. The Electronic Trade Facilitation Act standardises e-documents and operationalises the National Electronic Trade Platform. The Framework Act on Electronic Transactions and the Digital Signature Act complement this framework by providing the necessary legal certainty for electronic records and digital signatures (Koh, 2024[21]). Korea ranks among the top APEC economies in trade facilitation performance, particularly in the areas related to paperless trade environment (Figure 3.9) reflecting the strength of its enabling regulatory environment. Korea also has relatively low digital services restrictiveness in areas essential for *going paperless* among APEC regional peer economies, highlighting its readiness for the adoption of advanced digital and AI-driven systems (Figure 3.10).
- **The digitisation of trade-related documents:** uTradeHub (electronic trade platform that links trading companies with banks, logistics providers, and government agencies) facilitates the digital trade documents, including e-Letters of Credit and electronic Bills of Lading. E-Certificates of Origin and simplified export declarations specifically designed for e-commerce significantly reduced data entry burdens for businesses. The system also allows firms to handle negotiation documents electronically without visiting financial institutions. The KCS has also formalised a digital data sharing arrangement with private sector and domestic border agencies for supply chain risk management. These include collaboration with express carriers to report delivery destinations for information-sharing with market surveillance authorities to detect illicit goods.
- **The digitalisation of trade-related processes:** The seamless integration of UNI-PASS and uTradeHub creates a comprehensive Single Window environment connecting regulatory agencies. To further streamline operations, the KCS deployed automation software to handle repetitive administrative tasks, such as trade statistics processing and overtime computations.
- **The adoption of digital technologies (other than AI):** Blockchain technology is deployed for the Electronic Origin Data Exchange System for the electronic submission of Preferential Certificate of Origin and e-Declaration of Origin.

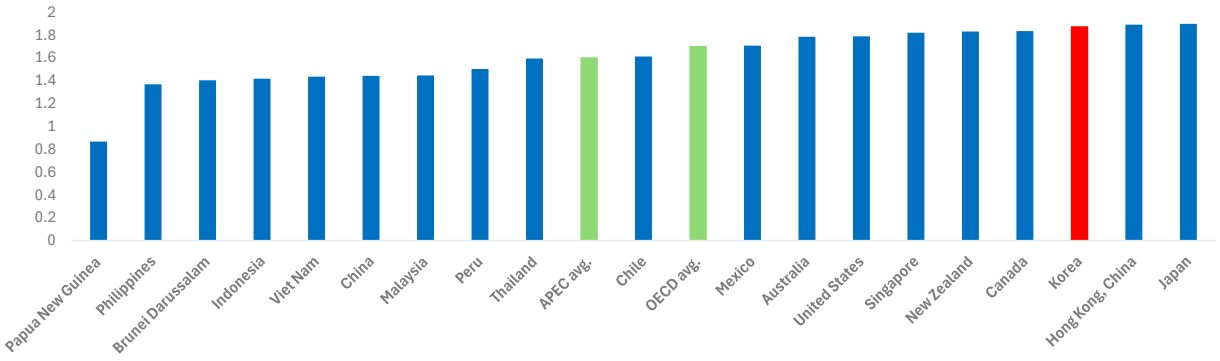
- **The standardisation of data elements:** To ensure cross-border interoperability, the KCO adheres to global standards, including the World Customs Organization (WCO) Data Model and UN/LOCODE for location identification. Postal operators are required to use electronic versions of WCO/Universal Postal Union standard forms (CN 22 and CN 23) to enable pre-advice and efficient clearance. Additionally, the United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT) modelling methodology has been adopted for supply chain data to ensure compatibility with foreign customs systems.

## Figure 3.8. Korea's building blocks for *going paperless*



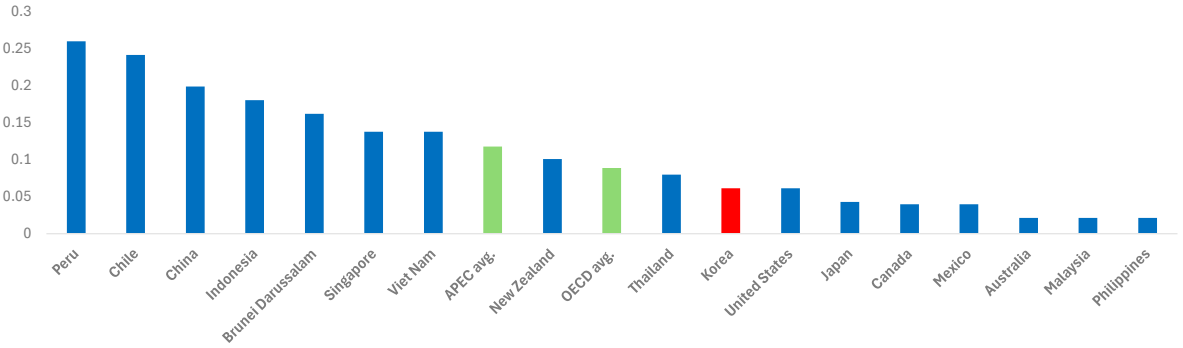

Source: based on (Korea Customs Service, 2025[22]) and (Koh, 2024[21]).

## Figure 3.9. Korea is among the top performers in the Asia-Pacific Economic Cooperation (APEC) region in trade facilitation areas underpinning *going paperless*




Note: This figure presents, for each APEC economy, the average of OECD Trade Facilitation Indicators (TFIs) scores across five areas: automation, documents, procedures, internal border agency co-operation and external border agency co-operation.
Source: OECD TFIs database, 2025.

## Figure 3.10. Low digital services trade restrictiveness indicates Korea's high readiness among Asia-Pacific Economic Cooperation (APEC) economies for *going paperless* across supply chains




Note: This figure presents, for each country, the sum of digital services restrictiveness across three areas: (1) infrastructure, (2) electronic transactions, and (3) payment systems.
Source: OECD Digital Services Trade Restrictiveness Index (Digital STRI) Index, 2026.

Korea's experience shows that digital and AI-enabled customs reform is not just about improving border procedures but about strengthening the efficiency and resilience of entire supply chains with participation of various actors across multiple layers of key policy components. Such co-ordination can help reduce delays, mitigate risks, and maintain supply chain resilience even under rapidly expanding trade volumes and external shocks.

# 4 From efficient to environmentally performing supply chains

Environmental performance measures increasingly ask firms to report on their carbon footprints, demonstrate compliance with deforestation-free rules, or verify upstream production practices. Without interoperable digital systems, these requirements can become burdensome and risk disrupting supply chains. This matters for the trade facilitation agenda: the same border systems that AI relies on for efficiency – digitised documents, common data standards, digital Single Windows, and secure cross-border data exchange – will also determine whether new environment-related requirements can be integrated smoothly rather than only added as parallel, duplicative processes. In other words, promoting both AI-enabled facilitation and the efficient integration of environmental performance requirements requires the same digital and interoperable architecture – linking registries, certificates, and product-level attributes directly into risk management, documentary and data workflows.

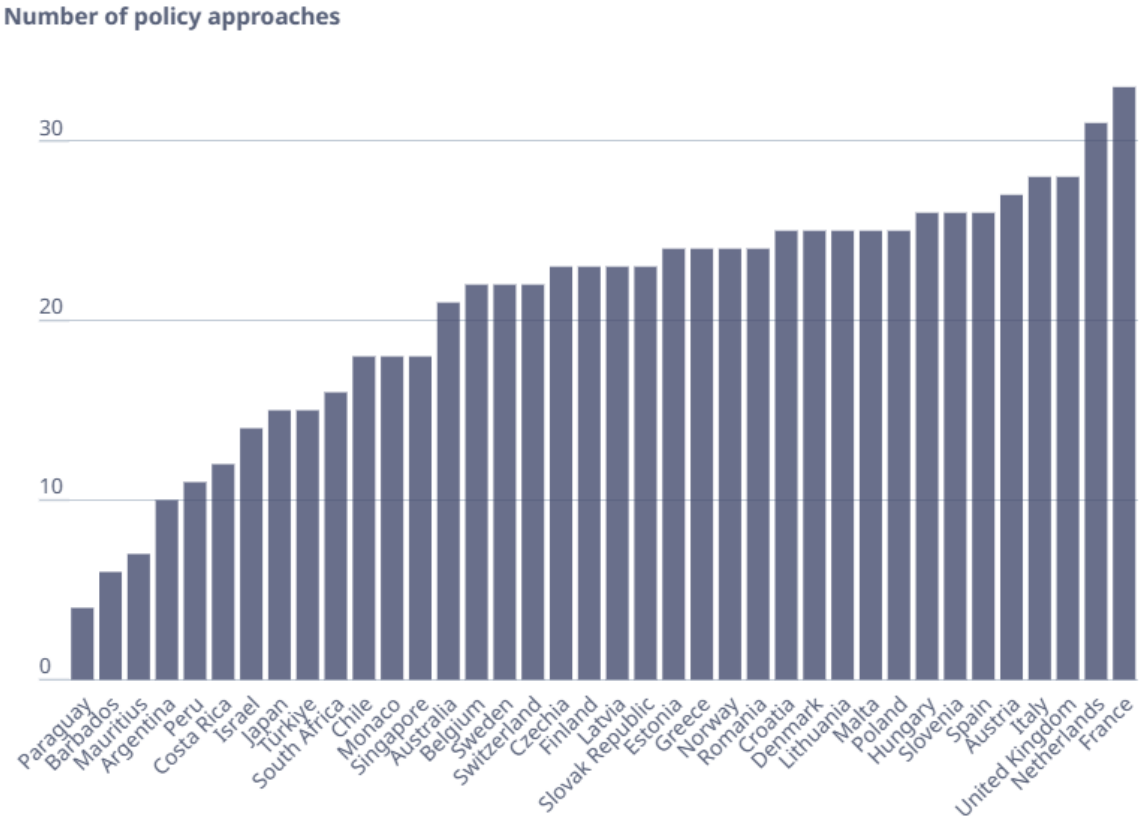
## 4.1. Environmental-related requirements in trade-related contexts

Many governments are increasingly considering and introducing measures based on non-product-related process and production methods (NPR-PPMs)[5] in response to growing demand from consumers, investors, and regulators for more detailed and reliable information on how goods are produced (OECD, 2024[23]; OECD, 2025[24]). Such approaches have emerged notably in the area of environmentally performing supply chains, including information on carbon footprints, resource efficiency, and the assessment of products' wider impacts on deforestation, pollution, or biodiversity (Jaax and van Lieshout, 2025[25]; Pauwelyn, 2024[26]; World Bank, 2025[27]).

What began as market-driven environmental sustainability commitments is increasingly embedded in regulations, requiring companies to substantiate claims with verified data and to meet specific thresholds or performance criteria. This shift changes compliance costs for firms of all sizes: it raises the need for robust internal data systems, expands the scope of documentation and audits, and introduces potential trade frictions where requirements diverge across jurisdictions. For public authorities, the move toward mandatory rules necessitates ensuring availability and transparency of related requirements, enhanced verification capacity, and closer co-ordination between customs and competent environmental agencies (OECD/BIAC/WEF, 2023[28]).

Policies with environmental objectives and with potential implications across supply chains are growing internationally. For instance, the OECD's Inclusive Forum on Carbon Mitigation Approaches (IFCMA) Climate Policy Database documents 1 600 individual policy instruments grouped within 43 policy approaches (e.g., comparative energy efficiency labels, framework regulations, performance standards, subsidies, taxes, technology standards, and emission trading schemes) across 38 economies. Figure 4.2 shows the number of adopted policy approaches by countries as of 2024.

**Figure 4.1. Policy approaches with emissions reductions objectives, by country (as of 2024)**




Note: The chart reflects information available for the 38 economies covered in the database. The database distinguishes 43 policy approaches across countries, which have adopted diverse climate mitigation strategies reflected in the number and approach of policy instruments in place. Each column shows how many of the 43 policy approaches are adopted in the country. There are five main instrument categories: Economic instruments, Regulatory instruments, Information instruments, Government consumption and investment instruments, and Voluntary approaches. Each of these instrument categories is further divided into instrument groups. Economic instruments are split into taxes, subsidies and trading schemes, while regulatory instruments are split into performance standards, technology standards and framework regulations.
Source: based on Inclusive Forum on Carbon Mitigation Approaches (IFCMA) Climate Policy Database, https://www.oecd.org/en/data/dashboards/ifcma-climate-policy-dashboard.html.

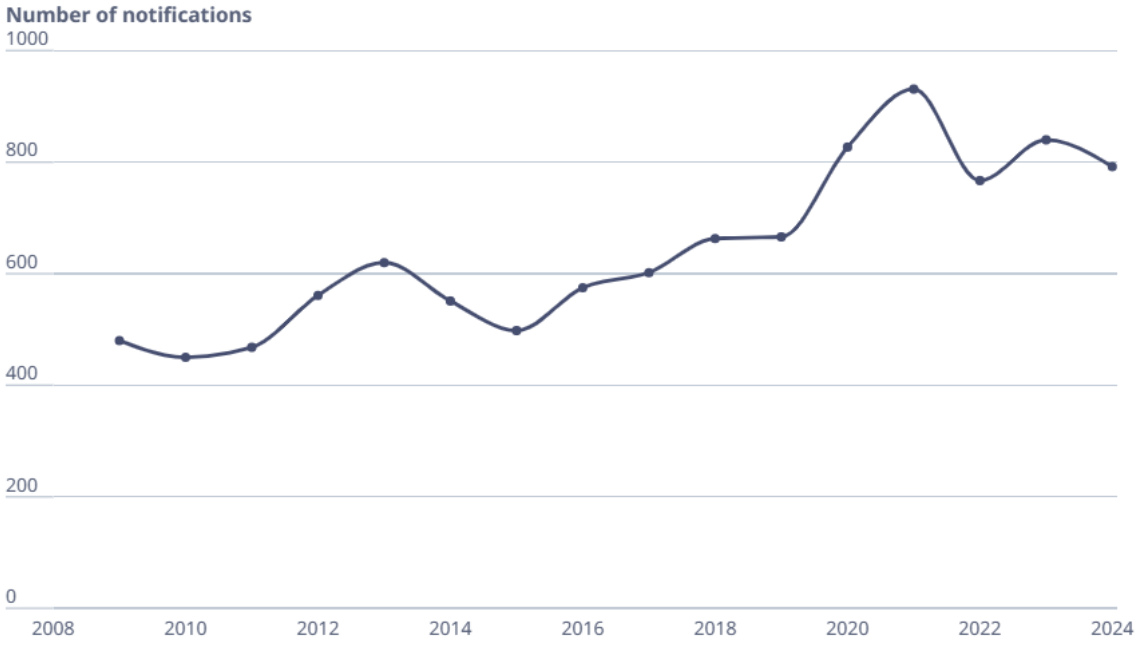
Moreover, the number notifications of environmental-related technical requirements to the World Trade Organization (WTO) have risen steadily (Figure 4.1), reflecting the growing reliance on regulatory tools to support environmentally performing supply chains. These notifications span eco-design and energy-efficiency rules, labelling and disclosure schemes, emissions reporting, and requirements for deforestation-free or low-carbon products (WTO, n.d.[29]).

Yet the regulatory landscape remains heterogeneous, differing in product scope, objectives, information requirements, thresholds, and institutional design – and this diversity can fragment compliance pathways. Some regimes emphasise product-embedded emissions or carbon content (e.g., border carbon mechanisms), while others focus on due diligence obligations to identify and mitigate environmental risks in supply chains, or on scheme-based recognition of environmental sustainability standards for specific commodities. These differences matter operationally: they influence what data must be collected, how it should be formatted and verified, and which authority must receive it – and at which stage of the transaction.

Some environmental measures require enforcement primarily behind-the-border – for instance, through periodic reporting obligations or corporate disclosure requirements. Others impose obligations at, or prior

to, the point of import, where companies must demonstrate compliance before their goods can enter the market. In practice, many mandatory environmental-related initiatives trigger at least some enforcement at the border, creating new operational interfaces with customs procedures and raising practical questions about how environmental information is captured, linked to declarations, and incorporated into risk management and clearance processes (OECD, 2025[14]).

## Figure 4.2. Notifications of environmental-related technical requirements are on the rise




Note: Number of environment-related Technical Barriers to Trade (TBTs) notified to the World Trade Organization (WTO) by Members.
Source: based on WTO's Environmental Database (EDB): https://edb.wto.org/.

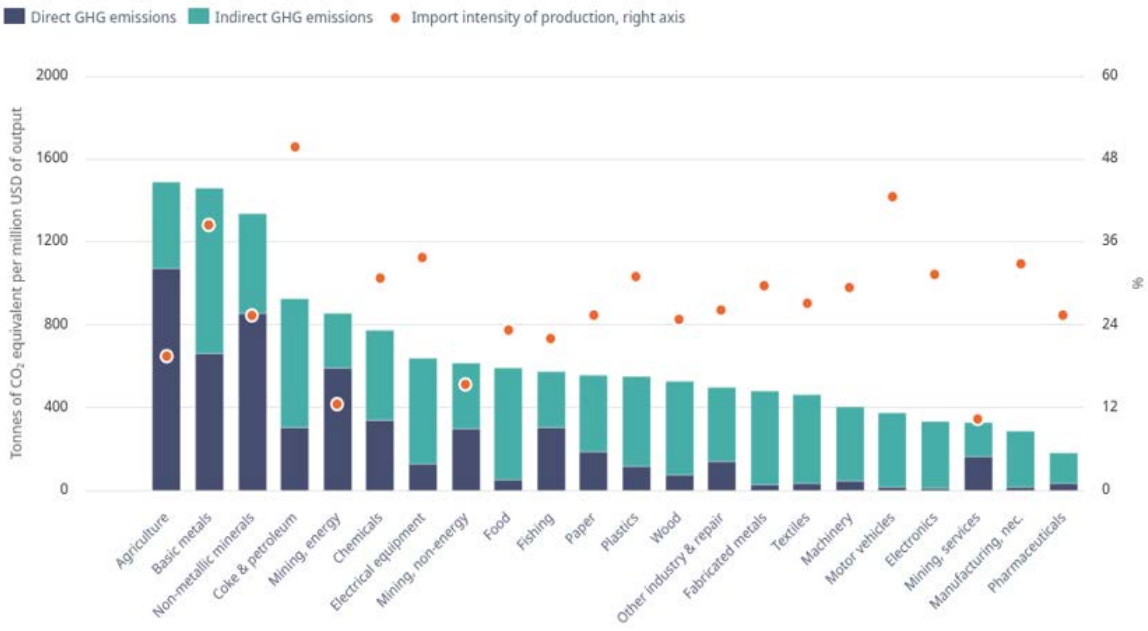
While NPR-PPMs are not new, the most recent wave of environment-related measures introduces a qualitatively higher level of operational complexity than earlier approaches. Many regimes now hinge on specific verification systems – such as Monitoring, Reporting, Verification (MRV) and Accreditation frameworks[6] – and require firms to assemble and exchange granular information that extends well beyond the factory gate. Data elements can include both upstream and downstream (Scope 3) greenhouse-gas (GHG) emissions, the use of standardised emissions factors, batch- or consignment-level attributes, geolocation co-ordinates for origin or land-use verification, and digital attestations from accredited bodies.

Meeting these requirements at scale places new demands on corporate data architectures and on public digital infrastructures: firms need to capture, structure, and share machine-readable evidence across multi-tier supplier networks, while authorities need interoperable systems capable of ingesting, validating, and linking environmental attributes to customs declarations, trade facilitation programmes and risk-management workflows. Absent such interoperability, compliance becomes burdensome, duplicative checks proliferate, and trade facilitation frameworks risk being disrupted just as they are delivering efficiency gains elsewhere (OECD, 2025[14]).

## 4.2. The implementation of environmental-related requirements has specific implications across sectors

In the case of GHG emissions, intensity per output varies widely across sectors and products, reflecting differences in production processes, supply chain structures, and dependence on imported inputs (Figure 4.3). Some industries generate a large share of emissions directly through energy or materials intensive operations, while others embed significant emissions indirectly through the inputs they source from upstream suppliers (Balaban et al., 2025[30]). These patterns matter for the implementation of some environmental requirements: they shape the type of data firms must collect, the extent to which emissions information must be traced along supply chains, and the nature of evidence that border and regulatory authorities must verify.

### Figure 4.3. Upstream and downstream value chain emissions across sectors




Note: The figure shows greenhouse-gas (GHG) emissions per unit of final product (left axis), as well the import intensity of production (right axis). A distinction is made between "direct" emissions generated in the production of the final product itself and "indirect" emissions that arise upstream in the supply chain. The import intensity of production is a measure of the international fragmentation of production. It captures the cumulated use of imported intermediate inputs throughout the supply chain, expressed as a percent of the value of final output. The results in this chart can be interpreted as averages over all OECD countries.
Source: Balaban et al. (2025[30]).

Diverging emissions intensities across sectors and products can also influence where compliance burdens are likely to fall and highlight the critical role of digital tools and standardised data models in integrating environmental information into existing trade facilitation frameworks without creating additional friction:

- **Energy and raw materials intensive sectors** (including basic metals, non-metallic minerals, coke and petroleum): in this case, high levels of direct emissions require robust MRV ready evidence, including plant-level data, metering information, and accredited verification. Where relevant, border processes would require specific capacity to ingest machine readable certificates and registry identifiers linked to tariff lines and consignments.
- **Mid-stream manufacturing** (including chemicals, electrical equipment, paper, plastics, fabricated metals, wood): in this case, high indirect emissions imply firms must obtain detailed, product level

emissions data from their suppliers. Interoperable data models and consistent identifiers (e.g., facility IDs, product or carbon footprint IDs) would be essential to enable customs systems, as relevant, to validate claims efficiently and avoid manual reconciliation.

- **Complex assembly sectors** (including machinery, motor vehicles, electronics, textiles): these sectors tend to have lower direct emissions but high import intensity, making compliance dependent on reliable upstream information. Border authorities increasingly need the ability to access trusted registries or recognised scheme databases rather than rely solely on documents submitted at the point of import.
- **Agriculture, food and fisheries**: although emissions profiles vary, these sectors face distinctive traceability demands, such as geolocation, land use, and vessel trip verification for deforestation free or illegal, unreported and unregulated fishing related requirements.
- **Pharmaceuticals and selected services sectors**: these sectors sit at the lower end of emissions intensity but are still subject to reporting, due diligence, and supplier screening obligations. SMEs may face disproportionate challenges unless data templates, simplified digital reporting tools, and reusable documentation formats are available across jurisdictions.

## 4.3. The requirements can have specific implications for stakeholders behind- and at-the-border

Effective implementation also requires co-ordination across a much wider ecosystem of actors than might be more characteristic of other border processes. Firms, customs administrations, environmental regulators, other border agencies, accredited verification bodies, and digital system providers would all play a role in generating, validating, transmitting, and using environmental data. This co-ordination must support a structured sequence of checks: identifying the product and assessing whether the measure applies; verifying authorisations, certificates, or registry references; and enabling data exchange between customs and competent authorities before release.

As highlighted in the previous sections (see Section 2.2.1 on *going paperless*), the digitalisation of trade-related documents and procedures is already complex and resource-intensive for both firms and administrations and evolving environmental requirements may compound these challenges. Additional data demands, heterogeneous reporting formats, and new verification channels risk adding friction unless carefully integrated into existing systems. To ensure that environmental sustainability measures can be implemented effectively without undermining trade facilitation objectives, two forms of *interoperability* are essential. *Regulatory interoperability* concerns the alignment of information requirements – ensuring, for example, that emissions data or sustainability certificates collected under one jurisdiction's rules can be recognised or reused in another.

*Technical interoperability* concerns the digital architecture itself: how different actors and systems exchange, process, and verify information in practice. Together, these forms of interoperability determine whether environmental requirements can be embedded into border processes in a predictable, efficient, and scalable way (OECD, 2025[14]; Stenzel and Waichman, 2023[31]). Against this background and building on existing work on *going paperless* (OECD, 2025[14]), this paper focuses on the technical interoperability challenges in the context of environmental-related requirements.

# 5 The implementation of environmental-related requirements through a trade facilitation lens

The same digital infrastructure underpinning risk management systems, Single Window environments, pre-arrival processing, and digital data exchange platforms can serve as the foundation for integrating environmental requirements – so long as the underlying data, registries, and information systems are interoperable. In this way, trade facilitation provides a practical lens for embedding environment-related checks into existing clearance processes rather than creating separate or duplicative workflows.

The efficient implementation of environmental requirements therefore depends on several core procedural and institutional trade facilitation elements (see also Section 3.3) that underpin border systems. These include clear and accessible information on requirements; the ability to manage and exchange data electronically; streamlined and well-sequenced procedures; and strong institutional arrangements for co-ordination among border agencies. The integration of environmental data into border processes necessarily introduces new actors – environmental authorities, verification bodies, registry managers – whose systems must align with those of customs and border agencies. Effective co-ordination is essential to avoid parallel processes, conflicting instructions, or duplicated checks at the border.

Border agency co-operation – both domestically and across borders – will be critical for sharing information, aligning procedures, and ensuring that sustainability checks are incorporated into clearance processes in a seamless and predictable way. When agencies can jointly access trusted data, interoperable registries, and common digital platforms, they can manage environmental obligations without compromising the speed, efficiency, or integrity of border operations. Strengthening these co-operation mechanisms – as highlighted in Section 3.3 – will therefore be essential to not only seize the benefits of modern trade facilitation but also to respond to the growing demand for environmentally performing supply chains.

## 5.1. Technical interoperability in the context of environmental requirements across supply chains

Ensuring technical interoperability is essential for integrating environmental requirements into border and regulatory processes in a predictable and efficient manner. In practice, interoperability relies on three mutually reinforcing layers: the alignment of underlying data elements, the standardisation of relevant documents, and the compatibility of data-exchange systems that enable information to flow reliably between domestic agencies and across borders. When these layers function cohesively, they reduce compliance burdens for firms, support effective enforcement for authorities, and enable environmental objectives to be met without disrupting trade. However, gaps in any one layer can create significant

operational challenges. The sections that follow first outline the main obstacles that firms and administrations face in achieving technical interoperability, and then consider how existing trade facilitation frameworks and emerging technologies can offer practical solutions.

### *5.1.1. Challenges to achieving technical interoperability*

Export-intensive firms that operate across several jurisdictions face particular challenges when required to comply with divergent data formats, reporting templates, and verification channels. The burden is even heavier for smaller firms, which often lack the resources to invest in digital data collection tools or the technical capacity to assemble complex datasets such as Scope 3 emissions or supplier-level attestations. These constraints are especially pronounced in developing and low-income countries, where firms and administrations typically have more limited access to digital infrastructure and fewer opportunities to participate in standard-setting initiatives (OECD/BIAC/WEF, 2023[28]).

Compounding these challenges, guidance on how environmental requirements should interface with border processes remains limited across many regulatory regimes (OECD, 2025[32]). As a result, firms must navigate both new operational steps at the border – such as identifying goods subject to environmental rules, verifying authorisations or thresholds, and submitting environmental data – and parallel challenges behind the border, where economic operators must obtain reliable emissions information from their supply chains. The dual nature of these obligations makes the absence of interoperable systems even more costly. Without predictable and consistent approaches, environmental requirements risk creating bottlenecks, duplicating verification efforts, and undermining the efficiency gains achieved through systemic trade facilitation reforms.

### *5.1.2. Trade facilitation frameworks and emerging technology tools can provide solutions*

A trade facilitation lens offers a practical route to enhancing technical interoperability and integrating environmental requirements into border operations while minimising frictions. Where trade facilitation systems rely on structured data, standardised processes, and automated risk management tools, they provide a foundation for embedding environment-related checks without overhauling existing procedures.

Environmental requirements can be integrated into existing trade facilitation mechanisms by adapting risk management systems, authorised operator programmes, and pre-arrival processing channels to include relevant sustainability attributes. Lessons from areas such as sanitary and phytosanitary e-certification demonstrate how digital documents and registry references can be incorporated into border workflows. Digital platforms – including Single Window environments and trusted registries – could offer paths for environmental data to be exchanged securely and consistently across agencies.

Emerging technologies, including AI, can further support implementation. Machine-readable codes, traceability tools (e.g., track-and-trace, digital product passports), and regulatory identifiers can help authorities link environmental information to specific consignments. As exemplified in section 2.2, AI tools might assist customs in identifying anomalies, verifying environmental certificates, or assessing risk based on emissions or traceability indicators. The private sector plays an important role in this landscape. Initiatives such as the Partnership for Carbon Transparency, Catena-X in the automotive sector, and Together for Sustainability (TfS) in chemicals provide shared platforms through which firms can develop and exchange primary data-based product footprints (OECD, 2025[14]). These initiatives demonstrate the value of data frameworks that allow companies to obtain granular environmental information from their suppliers.

## 5.2. The role of international co-ordination and co-operation

International co-operation offers further opportunities to leverage trade facilitation for efficient implementation of environmental requirements. Multilateral, plurilateral and regional discussions can provide venues for sharing experiences and further exploring the concrete role of trade facilitation and technical interoperability. Discussions within international organisations – including the OECD through the IFCMA, the WTO through bodies such as the Committee on Trade and Environment and the Trade and Environmental Sustainability Structured Discussions, the WCO, UNCTAD, UN/CEFACT[7], as well as APEC – could help policymakers exchange information on emerging practices and consider how different policy tools interact with trade flows and technical interoperability issues. Such dialogue can contribute to reducing uncertainty for firms while supporting the effectiveness of environmental policies.

Practical tools and platforms developed by public and private actors can complement these co-operative efforts. For example, digital registries, data sharing mechanisms, and sector-specific frameworks can support more consistent approaches to reporting and verification. Illustrative initiatives – such as those developing harmonised reporting templates or facilitating the secure exchange of product-level environmental information – demonstrate how structured data systems can help firms navigate environmental requirements in multiple jurisdictions. While approaches differ across sectors and regulatory contexts, such tools highlight the potential benefits of predictable, interoperable systems that facilitate compliance while supporting well-functioning and resilient supply chains (OECD, 2025[14]).

# 6 Conclusions and policy observations

AI and evolving environmental requirements are two drivers reshaping global supply chains. The effective deployment of AI requires digital tools, trusted data, and interoperable systems. Environmental requirements may disrupt trade flows and lead to increasing trade costs if not implemented with the help of digital tools, trusted data and interoperability of systems. Trade facilitation and the digitalisation of trade facilitation frameworks provide the architecture that connects these agendas: the same systems that enable risk-based controls, automated document handling, and efficient clearance can also support robust sustainability verification. As both efficiency and environmental performance become central to supply chain governance, paperless trade, standardised data models, and coherent digital infrastructure emerge as preconditions for success.

Realising the benefits of this transformation requires more than technology alone. The enabling environment – access to AI-relevant services and hardware, secure mechanism for cross-border data exchange, legal frameworks for electronic transactions, and strong institutional capabilities – determines whether AI can be deployed at scale and whether environmental requirements can be integrated smoothly into border operations. The experience of digitally advanced economies such as Korea shows that long-term investment in digitalisation and data standardisation can unlock the potential of AI-enabled facilitation.

At the same time, the expansion of environment-related requirements introduces new data demands, verification steps, and interactions between customs, environmental authorities, and other relevant border agencies. These obligations risk creating parallel processes unless they are efficiently embedded in existing trade facilitation frameworks. Technical interoperability is therefore essential to avoid fragmentation, reduce compliance costs, and maintain efficient border operations. Equally important is effective border agency co-operation: just as AI depends on co-ordinated institutional arrangements, the implementation of environmental requirements requires customs, environmental regulators, and other authorities to work together through shared systems and aligned procedures.

These developments point altogether to several key areas for policy action:

- **Advancing interoperability**, through common data models, interoperable registries and certification systems, and integration of environmental data into existing trade facilitation architectures.
- **Enhancing supply chain resilience**, by embedding environment-related and compliance information into border processes and digital tools for trade facilitation while preserving predictability and efficiency.
- **Investing in enabling ecosystems**, including digital infrastructure, legal recognition of electronic transactions, and institutional capacity across border agencies. AI can only be scaled up in border settings when documents and processes are digitised, data elements are standardised, and systems interoperate – with legal certainty for electronic transactions and secure cross border data exchange.

- **Promoting mechanisms for inter-agency co-ordination**, ensuring operational co-operation between customs, environmental authorities, and other regulators to enable the use of emerging technologies such as AI and support coherent implementation of new requirements enforced at the border.
- **Enhancing international co-operation**, including as regards the layers underpinning technical interoperability: the alignment of underlying data elements, the standardisation of relevant documents, and the compatibility of data systems that enable information to flow reliably between domestic agencies and across borders.

# References


Aaronson, S. (2024), *The Age of AI Nationalism and its Effects*, https://doi.org/10.2139/ssrn.4803311. [16]

Anderson, D., A. Belcineanu and M. Tzvetkova (2025), *AI for Border Management and Customs Controls – Anthology of EU-funded projects, 2015-2024*, Publications Office of the European Union, https://doi.org/10.2760/1286492. [12]

Balaban, C. et al. (2025), "Towards more environmentally sustainable supply chains: The role of trade agreements and sustainability initiatives", *OECD Trade Policy Papers*, No. 293, OECD Publishing, Paris, https://doi.org/10.1787/8bf5cb62-en. [30]

Burri, M., M. Callo-Müller and K. Kugler (2025), *TAPED: Trade Agreement Provisions on Electronic Commerce and Data*, https://www.unilu.ch/en/faculties/faculty-of-law/professorships/burri-mira/research/taped/ (accessed on 24 February 2026). [20]

Cohen, M. and C. Tang (2024), *The Role of AI in Developing Resilient Supply Chains*, https://gjia.georgetown.edu/2024/02/05/the-role-of-ai-in-developing-resilient-supply-chains/ (accessed on 23 February 2026). [7]

Deconinck, K., M. Jansen and C. Barisone (2023), "Fast and furious: the rise of environmental impact reporting in food systems", *European Review of Agricultural Economics*, Vol. 50/4, pp. 1310-1337, https://doi.org/10.1093/erae/jbad018. [2]

Ferencz, J., J. López González and I. Oliván García (2022), "Artificial Intelligence and international trade: Some preliminary implications", *OECD Trade Policy Papers*, No. 260, OECD Publishing, Paris, https://doi.org/10.1787/13212d3e-en. [4]

Goldfarb, A. and D. Trefler (2018), *AI and International Trade*, https://doi.org/10.3386/w24254. [17]

Jaax, A. and E. van Lieshout (2025), "Mapping efforts to protect worker rights in supply chains", *OECD Trade Policy Papers*, No. 291, OECD Publishing, Paris, https://doi.org/10.1787/f4eacea7-en. [25]

Koh, J. (2024), *Paperless trade system of the Republic of Korea: an analysis of the UNIPASS*, https://hdl.handle.net/11362/80691. [21]

Korea Customs Service (2025), *Transforming Customs Procedures Through Data and Artificial Intelligence (AI): Integrating AI into Korean Customs Operations*, https://mddb.apec.org/Documents/2025/SCCP/SCCP2/25_sccp2_015.pdf. [22]

McKinsey & Company (2025), *Beyond automation: How gen AI is reshaping supply chains*, https://www.mckinsey.com/capabilities/operations/our-insights/beyond-automation-how-gen-ai-is-reshaping-supply-chains#/ (accessed on 23 February 2026). [8]

Mikuriya, K. (2016), *Digital Customs, the opportunities of the Information Age*, WCO News, https://mag.wcoomd.org/magazine-tags/digital-customs/. [13]

OECD (2025), *OECD Supply Chain Resilience Review: Navigating Risks*, OECD Publishing, Paris, https://doi.org/10.1787/94e3a8ea-en. [1]

OECD (2025), *OECD Trade Facilitation Indicators: Monitoring Policies up to 2025*, OECD Publishing, Paris, https://doi.org/10.1787/fd6f27dc-en. [18]

OECD (2025), "The carbon footprint of everything", *OECD Net Zero+ Policy Papers*, No. 6, OECD Publishing, Paris, https://doi.org/10.1787/ae22f8e8-en. [24]

OECD (2025), "The digitalisation of trade documents and processes: Going paperless today, going paperless tomorrow", *OECD Trade Policy Papers*, No. 297, OECD Publishing, Paris, https://doi.org/10.1787/64872f25-en. [14]

OECD (2025), *The OECD Index of Digital Trade Integration and Openness (INDIGO): Policy Trends up to 2025*, OECD Publishing, Paris, https://doi.org/10.1787/623087f9-en. [19]

OECD (2025), "Towards interoperable carbon intensity metrics: Assessing and comparing selected data sources", *Inclusive Forum on Carbon Mitigation Approaches Papers*, No. 8, OECD Publishing, Paris, https://doi.org/10.1787/a9cdb1ba-en. [32]

OECD (2024), *Recommendation of the Council on Artificial Intelligence*, https://legalinstruments.oecd.org/en/instruments/oecd-legal-0449. [15]

OECD (2024), "Towards more accurate, timely, and granular product-level carbon intensity metrics: challenges and potential solutions: An IFCMA report", *Inclusive Forum on Carbon Mitigation Approaches Papers*, No. 4, OECD Publishing, Paris, https://doi.org/10.1787/87bbd6bf-en. [23]

OECD (2020), *Getting goods across borders in times of COVID-19*, https://www.oecd.org/content/dam/oecd/en/publications/reports/2020/11/getting-goods-across-borders-in-times-of-covid-19_2a71c29d/972ada7a-en.pdf. [3]

OECD (forthcoming 2026), "Inclusive Forum on Carbon Mitigation Approaches Papers", in *Average carbon intensity metrics for policy use: Assessing the design of reference and default values", Inclusive Forum on Carbon Mitigation Approaches Papers*, OECD Publishing. [33]

OECD (forthcoming 2026), "Inclusive Forum on Carbon Mitigation Approaches Papers", in *Developing a robust and efficient international verification system for product-level carbon intensity metrics*, OECD Publishing. [34]

OECD/BIAC/WEF (2023), *Emissions Measurement in Supply Chains: Business Realities and Challenges*, https://www3.weforum.org/docs/WEF_Emissions_Measurement_in_Supply_Chains_2023.pdf . [28]

Outram, M. and P. Swartz (2026), "Modern border management: leveraging AI systems for strategic advantage", *World Customs Journal*, Vol. 20/1, p. 167, https://doi.org/10.55596/001c.159458. [11]

Pauwelyn, J. (2024), *Twenty-first century customs fraud: how to effectively enforce EU sustainability requirements on imports*, Journal of International Economic Law, Volume 27, Issue 2, https://doi.org/10.1093/jiel/jgae013. [26]

Stenzel, A. and I. Waichman (2023), "Supply-chain data sharing for scope 3 emissions", *npj Climate Action*, Vol. 2/1, https://doi.org/10.1038/s44168-023-00032-x. [31]

Sun, R. and D. Trefler (2023), "The impact of AI and cross-border data regulation on international trade in digital services: A large language model.", *NBER Working Paper*, https://doi.org/10.3386/w31925. [6]

Vijayakumar, S. (2025), "Technology-centric and Data-Driven Customs Risk Management for Supply Chain Security", *World Customs Journal*, Vol. 19/1, pp. 38-63, https://doi.org/10.55596/001c.131745. [9]

World Bank (2025), *Due Diligence in Supply Chains: The Case of the EUDR*, http://documents.worldbank.org/curated/en/099100925114533691. [27]

World Customs Organization (2025), *Detailed report on the adoption of artificial intelligence and machine learning in customs*, https://www.wcoomd.org/-/media/wco/public/global/pdf/topics/facilitation/activities-and-programmes/smart-customs/public-version_detailed-report-on-the-adoption-of-ai-and-ml-in-customs.pdf. [10]

WTO (2025), *World Trade Report 2025: How trade and AI can contribute to inclusive growth*, https://doi.org/10.30875/9789287074560. [5]

WTO (n.d.), *WTO's Environmental Database (EDB)*, https://edb.wto.org/. [29]

# Notes

[1] Procedures that allow for the submission and processing of trade-related documentation and information before the arrival of goods at the border.

[2] Platforms allowing traders to submit all necessary documentation and data required for import, export and transit procedures through a single-entry point.

[3] The APEC Economic Leaders endorsed the APEC Artificial Intelligence Initiative (2026-2030) as part of the 2025 APEC Leaders' Gyeongju Declaration in November 2025, recognising AI's potential to fundamentally reshape economies worldwide by unlocking new frontiers for innovation, enhanced productivity, improved competitiveness, economic prosperity and resilience.

[4] The total cross-border e-commerce flow (imports and exports combined) reached USD 3.2 billion in 2025, which is 3.5 times larger than the USD 908 million recorded in 2015, reflecting an average annual growth rate of 9.7% (Authors' calculation based on figures from the Korea Trade Statistics Service).

[5] The use of measures based on process and production methods (PPMs) in trade regulation is a long-standing policy issue. Non-product-related PPMs (NPR-PPMs) refer to processes and production methods that do not affect products' physical characteristics or functional performance but may have environmental or social impacts – unlike product-related PPMs, which alter the physical characteristics of products. The overall objectives of NPR-PPMs measures and approaches vary across economies and can include market-based incentives, regulatory thresholds, and eligibility criteria for public support.

[6] See (OECD, forthcoming 2026[33]; OECD, forthcoming 2026[34]) .

[7] Examples include the WCO Green Customs Action Plan, the UN Transparency Protocol, IPPC ePhyto, eCITES, eBASEL, and ASYCUDA.

# Strengthening Supply Chains through Efficiency, Resilience, AI and Environmental Performance

Global supply chains are being reshaped by multiple forces, but two have systemic reach: the rapid uptake of artificial intelligence (AI) and the expansion of environmental requirements linked to market access. Addressing both depends on a shared foundation – digitalised, interoperable and trusted trade systems. This report examines how trade facilitation policies and tools enabled by AI and broader digital technologies can enhance supply chain resilience, efficiency and environmental performance, while effectively responding to new data and verification needs. Reaping the benefits of AI requires a functioning paperless trade environment with regulatory and technical interoperability at its core. Preconditions for this are high levels of digitisation and data standardisation, legal certainty for electronic transactions, and openness to cross-border data flows. Co-ordinated border management and enhanced international co-operation are critical to deploying digital and AI-enabled solutions that preserve efficiency while advancing resilient and environmentally performing supply chains.

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