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APPLICATION OF ARTIFICIAL INTELLIGENCE IN MONITORING AND ENFORCEMENT OF SUSTAINABLE DEVELOPMENT COMMITMENTS IN FREE TRADE AGREEMENTS: LEGAL ISSUES AND IMPLEMENTATION STRATEGIES

TRẦN MINH CHIẾN[*]

Monitoring and implementing the commitment to sustainable development in free trade agreements is an urgent requirement and plays a fundamental role in the development of global trade. In this context, artificial intelligence has developed tremendously and has had essential applications in monitoring and enforcing these commitments. Through the implementation of commitments as well as mechanisms for monitoring and enforcing sustainable development in Free Trade Agreements, this article analyses and clarifies the roles of artificial intelligence in monitoring compliance with environmental and social commitments, assessing and forecasting compliance with sustainability commitments and automated monitoring systems. The application of artificial intelligence in monitoring and enforcing these commitments also raises legal issues regarding data privacy and security, compliance with international legal regulations, fairness and transparency in artificial intelligence monitoring. Thereby, the article provides implementation strategies and legal recommendations to optimize the application of AI in monitoring compliance with sustainable development commitments, in order to promote global economic development.

[*] Trần Minh Chiến, Researcher, Institute of International and Comparative Law, University of Economics and Law, Vietnam National University, Ho Chi Minh City, Vietnam. The author cn be contacted at tmchien112[at]gmail.com.

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I. INTRODUCTION

In the context of globalization, Free Trade Agreements (FTAs) play an essential role in promoting trade cooperation between countries, creating a favourable environment for the exchange of goods, services and investment.[1] In addition to economic benefits, FTAs are increasingly expanding to include sustainable development commitments, such as environmental protection, ensuring the legitimate rights and interests of subjects and promoting social justice.[2] These commitments not only contribute to the comprehensive development of member countries but also help them maintain international environmental and social standards. However, despite the existence of monitoring and dispute resolution mechanisms within the framework of these agreements, ensuring that these commitments are implemented effectively still faces many difficulties. Therefore, AI is a potential tool to improve the effectiveness of monitoring, evaluating and implementing sustainability commitments in FTAs[3] because it provides automation solutions, big data analysis and supports the monitoring of countries' compliance with environmental and social commitments.

In particular, the application of AI in monitoring sustainability commitments in FTAs also has challenges, especially in terms of the legal aspects of collecting and processing national data.[4] Member countries may encounter conflicts between national security requirements and data sharing for international monitoring systems, causing privacy and security issues[5], and not all countries are willing to share data or participate in global monitoring systems.[6] In addition, AI, though powerful, is not perfect in handling complex situations. This raises issues of ensuring the accuracy and fairness of AI tools used to monitor compliance with commitments. Countries may be affected by social, political or economic factors in implementing commitments, and AI needs to be designed to fit within each country's legal and

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[1] Rafael Leal Arca's et al., *The Contribution of Free Trade Agreements and Bilateral Investment Treaties to a Sustainable Future*, 23(1) ZEITSCHRIFT FÜR EUROPARECHTLICHE STUDIEN ZEUS 3 (2020).
[2] CLARA BRANDI & JEAN-FRÉDÉRIC MORIN, TRADE AND THE ENVIRONMENT DRIVERS AND EFFECTS OF ENVIRONMENTAL PROVISIONS IN TRADE, AGREEMENTS (2023).
[3] Etinosa Igbinenikaro & O.A. Adewusi, *Policy Recommendations for Integrating Artificial Intelligence into Global Trade Agreements*, 6(1) INT'L. J. ENG'G. RES. 1 (2024) [hereinafter Etinosa Igbinenikaro & O.A. Adewusi].
[4] David Banisar & Simon Davies, *Global Trends in Privacy Protection: An International Survey of Privacy, Data Protection, and Surveillance Laws and Developments*, 18 J. MARSHALL J. COMPUTER & INFO. L. 1 (1999).
[5] Aaditya Mattoo & Joshua P. Meltzer, *International Data Flows and Privacy: The Conflict and its Resolution*, 21 J. INT'L ECON. L. 769 (2018) [hereinafter Aaditya Mattoo & Joshua P. Meltzer].
[6] Rowena Rodrigues, *Legal and Human Rights Issues of AI: Gaps, Challenges and Vulnerabilities*, 4 J. RESPONS. TECHNOL. (2020) [hereinafter Rowena Rodrigues].

social systems, ensuring that no country is constrained or misjudged by these factors. Thus, there is a need for legal mechanisms to ensure that AI systems do not cause discrimination or bias in assessing the compliance of countries, [7] ensuring compliance with the principles of fairness, protection of human rights, and environmental protection.[8]

II. SUSTAINABLE DEVELOPMENT COMMITMENTS, MONITORING AND ENFORCEMENT MECHANISMS IN FREE TRADE AGREEMENTS

Within FTAs, sustainability commitments are becoming increasingly central, reflecting a growing awareness of the interconnectedness between international trade and environmental, social, and economic factors. [9] Commitments to sustainable development are incorporated into specific provisions along with monitoring and enforcement mechanisms to ensure effectiveness and fairness. For instance, the Sustainable Development Chapter in the EU-Vietnam Free Trade Agreement (EVFTA) requires the parties to commit to fulfilling international obligations regarding environmental protection and fundamental labour rights, such as freedom of association, collective bargaining rights, and other core labour standards in accordance with International Labour Organization (ILO) norms.[10] Similarly, the CPTPP includes provisions requiring member states to strictly enforce labour and environmental obligations. Notably, there are differences in approaches between FTAs in the Global North and Global South. For example, EU and Japan tend to impose stricter sustainable development commitments, accompanied by robust legal frameworks and monitoring mechanisms. Conversely, Global South nations, such as countries in Africa and South America, often face challenges due to limited resources and weaker legal mechanisms. In this context, developing countries advocate for financial and technical assistance to enhance their capacity to implement sustainable development commitments, including training, capacity-building for monitoring, and the development of appropriate legal instruments. It is evident that commitments in FTAs contribute to achieving sustainable development goals and help establish global standards for environmental protection, social rights, and economic fairness. However, the implementation of these commitments is far

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[7] JOSHUA P MELTZER, TOWARD INTERNATIONAL COOPERATION ON FOUNDATIONAL AI MODELS: AN EXPANDED ROLE FOR TRADE AGREEMENTS AND INTERNATIONAL ECONOMIC POLICY (Brookings Institution, (2023) [hereinafter Joshua P. Meltzer].

[8] George Charles Alter & Mary Vardigan, *Addressing Global Data Sharing Challenges*, 10 J. EMPIR. RES. HUM. RES. ETHICS. 317 (2015) [hereinafter George Alter & Mary Vardigan].

[9] Margareta Timbur & Spiridon Pralea, *International trade – Environment Relationship in the Context of Sustainable Development*, (Alexandru Ioan Cuza University, CES Working Paper, 2013).

[10] European Commission. (2020). EU-Vietnam Free Trade Agreement (EVFTA), https://ec.europa.eu/trade/policy/countries-and-regions/countries/vietnam.

from straightforward, as it involves numerous legal challenges related to effectiveness, fairness, and enforceability.

A. Environmental and Social Commitments in Free Trade Agreements

1. Commitments to environmental protection: reducing greenhouse gas emissions, protecting water resources, conserving biodiversity

The integration of environmental commitments into FTAs reflects the increasing responsibility of nations in balancing trade liberalization with sustainable development. As climate change, natural resource depletion, and biodiversity loss become pressing global concerns, many FTAs now incorporate specific provisions aimed at reducing greenhouse gas emissions, protecting water resources, and conserving ecosystems. These commitments not only help establish common standards for trade and environmental protection but also reinforce national responsibilities in fulfilling international obligations. According to Jean-Baptiste Velut et al., this trend is particularly evident in major FTAs such as the EVFTA, the United States-Mexico-Canada Agreement (USMCA), and the Paris Agreement on Climate Change.[11]

EVFTA, one of the most ambitious FTAs in terms of sustainable development commitments, mandates parties to implement obligations related to forest conservation, biodiversity protection, and marine environment management. It also requires compliance with the United Nations Convention on Biological Diversity (CBD) and the Paris Agreement on Climate Change, thereby promoting greenhouse gas reduction and climate adaptation efforts. Similarly, USMCA includes a dedicated environmental chapter, emphasizing the responsibility of member states in pollution control, resource protection, and adherence to multilateral environmental agreements. These provisions indicate a significant shift in modern FTAs, where environmental commitments are no longer just formal declarations but are increasingly embedded within the legal framework of trade agreements.

However, despite the establishment of common principles and objectives, the implementation of environmental commitments remains challenging, particularly in developing countries. One of the biggest obstacles is the limitation in monitoring and data collection mechanisms. Assessing compliance requires accurate data on greenhouse gas emissions, water quality, and biodiversity conservation, yet many developing nations lack the necessary technological infrastructure and rigorous monitoring systems. The absence of digital infrastructure and independent verification mechanisms raises concerns about the transparency and reliability of

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[11] Jean-Baptiste Velut et al., *Comparative Analysis of Trade and Sustainable Development Provisions in Free Trade Agreements* (London Sch. of Econ., 2022) [hereinafter Jean-Baptiste et al.].

environmental compliance reports.[12] This issue is particularly relevant as many nations prioritize economic growth over investments in environmental protection measures.

Another key challenge is the conflict between environmental protection and economic interests, especially in developing and least-developed countries. Enforcing stringent environmental standards increases production costs and reduces domestic firms' competitiveness, creating significant pressure on governments to balance economic growth with international commitments. Research by Longlong Guo and Hongbo Ma highlights that this conflict is particularly pronounced in heavy industries, resource extraction, and agriculture, where environmental regulations directly impact business operations and supply chains.[13] To address this challenge, many developing countries advocate for financial support and technology transfer from developed nations, enabling them to enhance enforcement capacity while minimizing adverse economic impacts.

Another crucial factor to consider is the difference in environmental approaches between the Global North and the Global South. Developed nations, such as the EU and Japan, tend to impose stringent sustainability commitments, accompanied by strict monitoring frameworks and strong enforcement measures. In contrast, Global South countries, particularly emerging economies, face difficulties in fulfilling these commitments due to resource limitations, weaker infrastructure, and governance challenges. As a result, effective monitoring of compliance must account for these implementation disparities among different economic groups to ensure a fair and enforceable system.

In this context, technology, particularly AI, is emerging as a key tool for monitoring and assessing environmental commitments. AI enables big data analysis, real-time tracking of deforestation, greenhouse gas emissions, and water pollution with greater accuracy than traditional methods. Recent studies have shown that AI can detect environmental violations more efficiently, reducing reliance on self-reported data from governments and industries.[14]

However, AI itself poses significant environmental sustainability challenges. One of the most concerning issues is its massive water consumption for cooling data centres,

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[12] OECD, *Environmental Performance Reviews* (2021) [hereinafter Environmental Performance Reviews].

[13] Longlong Guo & Hongbo Ma, *Conflict Between Developing Economic and Protecting Environment*, 1 J. SUSTAIN. DEV. 91 (2008).

[14] Sahil Kartikey et al., *Development of Mitigation Strategies for Climate Change Using Artificial Intelligence to Attain Sustainability*, in VISUALIZATION TECHNIQUES FOR CLIMATE CHANGE WITH MACHINE LEARNING AND ARTIFICIAL INTELLIGENCE 421 (Elsevier, 2023).

which strains water resources, particularly in arid regions.[15] Additionally, AI contributes significantly to CO_2 emissions, as operating high-power computing systems demands vast amounts of electricity, much of which is derived from fossil fuels. Research by Strubell et al. found that training a single large AI model can emit CO_2 equivalent to five cars over their entire lifespan.[16] Another study by Henderson et al. estimates that data centres account for approximately 1% of global CO_2 emissions, a figure expected to rise as AI adoption expands.[17]

Beyond emissions, the expansion of AI infrastructure leads to deforestation and biodiversity loss. The construction of large-scale data centres require vast land use, often resulting in deforestation and habitat destruction. Studies indicate that AI infrastructure expansion and cloud computing have contributed to the loss of over 100,000 hectares of forests in the past decade.[18] Furthermore, infrastructure expansion indirectly exacerbates environmental issues by increasing demand for non-renewable materials, intensifying mining activities, and raising pollution levels from construction processes.

Thus, while AI has the potential to enhance environmental compliance monitoring, it also generates considerable environmental costs that must be addressed. If left unmanaged, these negative externalities may undermine AI's intended role in advancing sustainability goals. Therefore, AI implementation in environmental governance must prioritize energy efficiency, renewable energy integration, and sustainable infrastructure development to mitigate its adverse ecological impact.

In conclusion, environmental commitments in FTAs play a crucial role in promoting sustainable trade and mitigating the adverse effects of economic activities on ecosystems. However, their implementation faces significant hurdles, including data collection challenges, conflicts between economic and environmental priorities, and disparities in enforcement capacity across nations. In this evolving landscape, technology offers valuable support, but it must be carefully regulated to prevent unintended environmental damage. A balanced approach integrating legal mechanisms, financial incentives, and technological solutions is essential to ensuring

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[15] Alexandre Lacoste et al., *Quantifying the Carbon Emissions of Machine Learning*, ARXIV (Nov. 4, 2019), https://arxiv.org/pdf/1910.09700.

[16] Emma Strubell et al., *Energy and Policy Considerations for Deep Learning in NLP*, in *Proceedings of the 57th Annual Meeting of the Association for Computational Linguistics* 3645 (2019).

[17] Peter Henderson et al., *Towards the Systematic Reporting of the Energy and Carbon Footprints of Machine Learning*, 21 J. MACH. LEARNING RSCH. 248 (2020).

[18] Rajat Gupta et al., *Deforestation and Biodiversity Loss Due to AI Infrastructure Expansion: A Global Perspective*, 5 ENV'T RSCH. & POL'Y 89 (2022).

that environmental commitments within FTAs contribute effectively to global sustainability efforts.

2. Commitments on labour rights and social development: improving working conditions, promoting gender equality and human rights

Commitments to labour rights and social development are increasingly becoming an integral part of FTAs.[19] These commitments include improving working conditions, promoting gender equality, and protecting human rights, thereby reflecting countries' commitment to international labour standards, while protecting vulnerable groups in society and ensuring a fair working environment, safe and non-discriminatory.

Legal issues related to labour rights and social development commitments mainly focus on monitoring and enforcing labour rights and social development provisions.[20] However, the re-implementation of these commitments still faces many challenges. One of them is the difference in legal systems and actual conditions between member states. Countries may have different labour standards, and aligning these standards with commitments in FTAs can cause conflicts of interest.[21] In addition, the implementation of these commitments also faces great difficulties in accurately assessing the labour situation, especially in countries with underdeveloped economies, where labour rights violations may not be adequately reported or hidden.

There are also issues related to the legal power to protect labour rights and promote gender equality, especially when there is controversy over whether these commitments may conflict with the internal regulations of countries, especially those with distinct cultural and social traditions. This is a legal factor that needs to be carefully considered while establishing and implementing these commitments in FTAs.

3. Commitments to sustainable economic development: economic growth, poverty reduction, and social justice

In FTAs, commitments to sustainable economic development are considered to be the core of promoting equitable economic growth among member states.[22] These

[19] The Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) has provisions on issues related to labour and gender equality; The EVFTA commits not to harm the enforcement of environmental and labour laws; The U.S.-Mexico-Canada Free Trade Agreement (USMCA) has provisions on gender equality.

[20] MARVA CORLEY-COULIBALY EL AT., PROMOTING AND ENFORCING COMPLIANCE WITH LABOUR PROVISIONS IN TRADE AGREEMENTS (2023).

[21] ANURADHA R.V. & NIMISHA SINGH DUTTA, TRADE AND LABOUR UNDER THE WTO AND FTAS (Centre for WTO Studies 2012).

[22] Jean-Baptiste et al., *supra* note 11.

commitments focus on GDP growth, while ensuring that this growth does not widen the gap between the rich and the poor, but instead helps reduce poverty and promote social justice.[23] These commitments include measures to redistribute economic benefits, improve job opportunities, and develop sustainable industries.

Legally, the implementation of commitments on sustainable economic development faces a number of limitations, especially the equitable distribution of economic benefits between developed and developing countries. Developed countries may have more resources and the ability to meet their sustainable development commitments, while developing countries struggle to achieve these goals due to a lack of resources and technology.[24] Another complex legal issue is the adjustment of trade policies to ensure sustainable development without harming the economic interests of member states. Therefore, international legal mechanisms need to build a fair and rational system, ensuring that the commitments for sustainable economic development in FTAs not only promote growth, but also ensure equity in the distribution of benefits and reduce inequality.

In conclusion, the sustainable development commitments in FTAs related to environmental protection, labour rights, and sustainable economic development have a major impact on building a fair and sustainable international trading system. However, the implementation of these commitments also faces many legal issues such as monitoring and assessing compliance, protecting national interests, and ensuring fairness in the process. Therefore, a solid international legal basis is needed to ensure comprehensive implementation of sustainable development commitments in FTAs.

a. Monitoring and enforcement mechanisms in Free Trade Agreements

Ensuring compliance with sustainable development commitments in FTAs presents a significant challenge and raises numerous complex legal issues. Effective monitoring and enforcement mechanisms are crucial in ensuring that member states fully implement their commitments.[25] These mechanisms include independent watchdogs, international monitoring systems, and dispute resolution mechanisms

[23] The Trans-Pacific Partnership (TPP), the EVFTA, the USMCA, all have commitments to promote sustainable economic growth such as expanding trade and investment, improving market access, economic growth measures that do not harm the environment, do not increase social differentiation, etc.

[24] Suriyanarayanan Sarvajayakesavalu, *Addressing Challenges of Developing Countries in Implementing Five Priorities for Sustainable Development Goals*, 7(1) ECOSYSTEM HEALTH & SUSTAINABILITY 1 (2015).

[25] Sandrine Maljean-Dubois & Vanessa Richard, *Mechanisms for Monitoring and Implementation of International Environmental Protection Agreements*, HAL Open Science (2004).

for addressing violations.[26] However, before analysing the role of AI in supporting these monitoring mechanisms, it is essential to clarify how independent watchdogs collect, monitor, and assess data to ensure that the commitments in FTAs are not merely symbolic but are effectively implemented.

Data collection in the process of monitoring compliance with sustainable development commitments in FTAs generally relies on national reporting systems, data from international organizations, and independent oversight by non-governmental organizations (NGOs) or intergovernmental bodies. Member states are obligated to submit periodic reports on their implementation of commitments related to environmental protection, labour rights, and sustainable development. However, these reports are often voluntary or lack independent verification mechanisms, leading to inaccurate or non-transparent reporting.[27] To address this issue, international monitoring frameworks, such as the EU's Trade and Sustainable Development Committee and the WTO's reporting mechanisms, play a supplementary role by objectively assessing data from multiple sources to ensure authenticity and completeness.

Beyond national reporting systems, on-the-ground monitoring is crucial for evaluating countries' compliance. Organizations such as the United Nations Environment Programme (UNEP), [28] the World Bank, [29] and specialised environmental NGOs frequently conduct field investigations, employing advanced monitoring tools such as satellite imagery, remote sensing, and big data analytics to track the environmental impacts of trade activities. Research suggests that satellite imagery can detect deforestation or water pollution at an early stage, particularly in countries that have committed to natural resource conservation under FTAs but lack stringent enforcement mechanisms.[30]

Additionally, data evaluation is not solely dependent on collected information but also on trade dispute resolution mechanisms concerning environmental issues. Some FTAs, such as EVFTA and USMCA, explicitly state that if a party violates environmental or labour commitments, arbitration mechanisms and independent

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[26] Gracia Marín Durán, *Sustainable Development Chapters in EU Free Trade Agreements: Emerging Compliance Issues*, 57 COMMON MKT. L. REV. 1147, 1160 (2020) [hereinafter Gracia Marín Durán].

[27] Environmental Performance Reviews, *supra* note 12.

[28] UNEP, *Global Environmental Outlook* (2020).

[29] World Bank, *Trade and Sustainable Development: A Review of Policy and Institutional Approaches* (2021).

[30] Mehling et al., *The Role of International Institutions in Environmental Compliance*, 23 ENV'T POL'Y REV. 89 (2020).

investigations can be triggered to address the dispute.[31] However, in practice, enforcement measures often rely on consultation and political dialogue rather than strict sanctions. This results in a lack of binding enforcement mechanisms, limiting the effectiveness of environmental commitments within FTAs.

In conclusion, monitoring and enforcement of sustainable development commitments in FTAs rely on a multi-layered data collection system, including national reports, international oversight, data from NGOs, and modern technologies such as AI, remote sensing, and satellite imagery. However, these mechanisms still face significant challenges, particularly concerning data transparency, disparities in enforcement capacity across countries, and the binding nature of dispute resolution mechanisms. Therefore, improving the effectiveness of monitoring and enforcement is essential to ensuring that sustainable development commitments in FTAs go beyond mere formalities and lead to meaningful environmental and social impacts.

b. Compliance Monitoring Mechanisms

The establishment of independent supervisory bodies is an indispensable element in FTAs to ensure transparency and fairness in monitoring compliance with commitment.[32] However, beyond general principles, it is necessary to examine specific FTAs that have established independent supervisory bodies with legal authority to require member states to provide relevant data.[33]

These supervisory bodies are responsible for monitoring and evaluating the implementation of the agreement's provisions, particularly commitments related to environmental protection, labour rights, and sustainable economic development. For instance, the EFTA Surveillance Authority, established under the European Economic Area Agreement, has the power to require member states to provide necessary information for compliance assessment and may initiate infringement proceedings in cases of violations.[34]

Similarly, the Dispute Settlement Mechanism of the African Continental Free Trade Area has established a Dispute Settlement Body, which is empowered to convene

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[31] Bartels, *Environmental Dispute Resolution in Free Trade Agreements*, in TRADE AND ENVIRONMENT: CHALLENGES AND OPPORTUNITIES 312 (2018) [hereinafter Bartels].
[32] PIERRE THIELBÖRGER, THE RIGHT (S) TO WATER: THE MULTI-LEVEL GOVERNANCE OF A UNIQUE HUMAN RIGHT 135, (2014) [hereinafter Pierre Thielbörger].
[33] EFTA Surveillance Authority, *Ensuring Compliance with EEA Rules* (2023).
[34] *Id.*

dispute panels, request reports from member states, and issue rulings on disputes concerning FTA commitments.[35]

Additionally, some FTAs, such as the United States-Mexico-Canada Agreement, have introduced an Environmental Affairs Council, which has the authority to monitor the implementation of environmental provisions and request compliance-related information from member states.[36]

These supervisory bodies may include international organizations, executive agencies of participating countries, or civil society organizations that possess sufficient legal capacity and international recognition to perform the supervisory function. Examining these specific models ensures that FTAs do not merely set commitments on paper but also establish effective enforcement mechanisms to guarantee transparency and accountability among member states. However, an unresolved issue remains: the balance between independent supervision and national sovereignty. While an independent supervisory body requires legal authority to demand compliance data from member states, the delegation of such power raises concerns over national sovereignty and internal control.[37] Some states remain reluctant to accept international oversight in their internal affairs.[38] Therefore, establishing these mechanisms requires consensus among all member states and must ensure fair and transparent operations.[39]

One of the fundamental monitoring mechanisms is requiring member states to submit periodic reports on the implementation of sustainable development commitments in FTAs.[40] These reports must include detailed information on national measures taken to fulfil commitments related to environmental protection, labour rights, and economic development. However, the accuracy and transparency of these reports may be compromised, as some states may submit incomplete or

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[35] African Continental Free Trade Area (AfCFTA), *Protocol on Rules and Procedures on the Settlement of Disputes* (2020).
[36] USMCA, *Environmental Chapter, Article 24.25* (2020).
[37] Bartels, *supra* note 31.
[38] Hoffmann, *Balancing Trade and National Sovereignty: Legal Challenges in FTAs* (2021) [hereinafter Hoffman].
[39] Gracia Marín Durán, *supra* note 26.
[40] Fabiano de Andrade Corrêa, *The Implementation of Sustainable Development in Regional Trade Agreements* (2013) (Ph.D. thesis, European University Institution).

misleading reports to avoid criticism or sanctions[41]. While AI can enhance data verification, it does not fully resolve the issue of state manipulation of reports[42].

To ensure credibility, independent verification mechanisms such as inspections and audits conducted by international organizations are necessary.[43] Examples of FTAs that have adopted such mechanisms include the EU-Korea FTA, which mandates independent review of labour and environmental reports, and the CPTPP, which includes a dispute resolution framework for non-compliance. [44] Nevertheless, concerns about national sovereignty and the legitimacy of these reviews persist, as states continue to resist external intervention.[45]

International monitoring mechanisms, such as global environmental and labour rights databases, play a significant role in assessing FTA compliance. These systems collect and analyse data from various sources to generate aggregate reports on the implementation of commitments. For instance, a global greenhouse gas emissions monitoring system can track progress in emission reduction commitments, enabling FTA participants to make timely policy adjustments.[46]

However, legal concerns persist regarding the accuracy, fairness, and transparency of data collection. Some states may hesitate to share sensitive data due to concerns over potential misuse for political or economic purposes.[47] Legal provisions must therefore ensure that data collection and disclosure processes are conducted transparently while protecting the legitimate interests of Member States.

c. Dispute settlement mechanisms in Free Trade Agreements

Although monitoring mechanisms play an essential role in monitoring compliance with commitments, the monitoring process can still lead to disputes that affect the interests of countries. Therefore, dispute settlement mechanisms in FTAs have become an essential part of the implementation system to effectively solve problems

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[41] Marjut Hannonen, *Implementation of EU Free Trade Agreements*, 12(11) GLOBAL TRADE & CUSTOMS J. 422 (2017).
[42] Pu Chen et al., *AI Fairness in Data Management and Analytics: A Review on Challenges, Methodologies and Applications*, 13(18) APPLIED SCI. 1 (2023).
[43] Environmental Performance Reviews, *supra* note 12.
[44] EU-Korea FTA, *Chapter 13* (2011); Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP), *Article 28.17* (2018).
[45] Hoffmann, *supra* note 38.
[46] George Charles Alter & Mary Vardigan, *supra* note 8.
[47] OECD, *Trade and Data Transparency* (2022).

that arise when a member state does not properly implement its commitment to sustainable development.[48]

Dispute resolution mechanism through arbitration or international courts. In the event that a country is accused of violating its sustainability commitments in FTAs, countries can request dispute resolution through arbitration or international tribunals.[49] These mechanisms help ensure that decisions about violations of commitments are made fairly, objectively, and based on international legal norms. However, the legal force and enforceability of these judgments on member states may not be guaranteed. This is because, although the decisions of arbitration or international tribunals are binding, not all countries are willing to comply with these awards, especially if the award may affect the economic or political interests of that country.

The involvement of international organisations in ensuring the implementation of commitments. International organizations, especially the United Nations, the ILO, and environmental protection organisations such as the UNEP play an essential role in monitoring and ensuring the implementation of sustainable development commitments in FTAs. These organisations participate in the monitoring process and have a role in intervening and making recommendations or sanctions when violations occur. International organizations can also assist member states in developing and improving legal systems and internal policies to ensure compliance with commitments.

However, the involvement of international organizations also causes problems related to national sovereignty. Accordingly, states may not want to let international organizations interfere in internal affairs, especially in areas where they consider international organizations to have no authority.[50] Therefore, ensuring the cooperation of countries in complying with sustainable development commitments requires a flexible legal mechanism that ensures the interests of countries while protecting international legal principles. From that basis, the monitoring and dispute resolution mechanisms in FTAs play an indispensable role in ensuring compliance with sustainable development commitments. However, for these mechanisms to work effectively, a strong, fair and transparent legal system is needed, along with

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[48] Kathleen Claussen, *Dispute Settlement Under the Next Generation of Free Trade Agreements*, 46(3) GA. J. INT'L & COMP. L. 611 (2017).

[49] Axel Marx et al., *Dispute Settlement for Labour Provisions in EU Free Trade Agreements: Rethinking Current Approaches,* 5(4) POL. & GOVERNANCE 49 (2017).

[50] RANDALL WARREN STONE, CONTROLLING INSTITUTIONS: INTERNATIONAL ORGANIZATIONS AND THE GLOBAL ECONOMY (2011).

close international cooperation between member states and international organizations.

III. APPLICATION OF ARTIFICIAL INTELLIGENCE IN MONITORING AND ENFORCEMENT OF SUSTAINABLE DEVELOPMENT COMMITMENTS

B. Monitoring compliance with environmental and social commitments using artificial intelligence

AI is becoming a powerful tool in monitoring and assessing compliance with sustainability commitments in FTAs. Environmental and social commitments in FTAs require participating countries to take measures to protect the environment, improve working conditions, protect human rights, and promote sustainable development.[51] However, tracking and monitoring these commitments has always been challenging in terms of data and assessment methods. Meanwhile, AI, with its ability to analyse and process big data, is opening up new possibilities in carrying out this monitoring work.

One of the obvious applications of AI in monitoring environmental commitments is its ability to analyse and monitor environmental indicators such as air pollution, water quality, and greenhouse gas emissions. AI can collect and aggregate data from various sources, including environmental sensors, satellite imagery, and country reports. A key distinction is that AI has the capability to process and analyse data in real-time, minimizing delays and enhancing accuracy in monitoring and evaluating sustainability commitments.[52] For instance, AI systems can analyse data from satellites to monitor air pollution levels, detect violations of greenhouse gas emissions, and provide timely warnings. These AI tools contribute to monitoring environmental indicators and can make predictions about future pollution trends, thereby supporting countries to adjust environmental policies proactively and effectively.

AI can also assist in monitoring social commitments, particularly in the protection of labour rights and social development. One of the major challenges in enforcing labour rights is that violations may go unreported or be deliberately concealed, especially in countries with underdeveloped economies. In this context, AI can play a crucial role in detecting hidden violations and addressing data gaps. Specifically, AI has the capability to analyse data related to working conditions, labour rights

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[51] Lorand Bartels, *Human Rights and Sustainable Development Obligations in EU Free Trade Agreements*, 40(4) LEGAL ISSUES ECON. INTEGRATION 297, 305 (2013).

[52] Mohamed Amine Ferrag et al., *Deep learning for Cyber Security Intrusion Detection: Approaches, Datasets, and Comparative Study*, 50 J. INFO. SEC. & APPLICATIONS 1 (2019).

violations, and human rights information from various sources. By processing labour reports, wage data, working conditions, and social issues, AI can identify irregularities, such as labour exploitation or inequality in work environments. Furthermore, AI can integrate data from human rights organizations or international reports to assess compliance with social commitments in FTAs, thereby aiding in the early detection and resolution of human rights violations.

However, a critical issue that must be addressed is that if the data is inaccurate or incomplete, AI may draw incorrect conclusions, leading to misjudgements about countries' compliance with commitments. To mitigate this risk, safeguards should be implemented, including cross-checking data from multiple sources, using AI to verify data reliability, and incorporate effective monitoring mechanisms to ensure that reports are not manipulated or lack transparency.

Another application of AI in monitoring social and environmental commitments is the ability to automate reporting and analytics in compliance with sustainability commitments.[53] In order to fulfil the responsibility of FTAs member states to provide periodic reports on the level of implementation of their sustainability commitments, AI can help automate and provide in-depth analytical reports on the level of compliance with commitments, reduce errors and increase transparency in the evaluation of environmental and social commitments. For example, AI can help analyse factors such as CO2 emissions, air pollution levels, unemployment rates, and labour rights indicators to provide a comprehensive report on compliance with commitments in FTAs.[54]

In fact, countries have begun applying AI to monitor the implementation of environmental and social commitments in trade agreements. One of the typical examples is the UNEP) which has deployed environmental monitoring systems using AI technology to monitor the level of compliance with environmental protection commitments of countries in FTAs.[55] The system uses AI to collect and analyse data from a variety of sources, including environmental sensors, satellite images, and data from national environmental agencies. Machine learning technology helps identify pollution trends, predict environmental impacts and provide real-time information on air, water and soil pollution levels in different areas. This not only helps countries evaluate the effectiveness of environmental policies

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[53] Sohana Akter, *AI for Sustainability: Leveraging Technology to Address Global Environmental*, 2(1) J. A.I. GEN. SCI. 41 (2024).

[54] Ye Zhiping et al., *Tackling Environmental Challenges in Pollution Controls Using Artificial Intelligence: A review*, 699 SCI. TOTAL ENV'T. 1 (2020).

[55] UNEP, How Artificial Intelligence Is Helping Tackle Environmental Challenges (Nov. 7, 2022), https://www.unep.org/news-and-stories/story/how-artificial-intelligence-helping-tackle-environmental-challenges.

but also supports timely adjustment measures to ensure compliance with commitments in FTAs. In addition, AI can also integrate historical data with climate factors to predict future environmental fluctuations, thereby providing appropriate policy recommendations. For example, UNEP's AI system has been used to monitor member countries' CO_2 emissions and provide early warnings of pollution levels exceeding permissible limits, thereby promoting timely interventions.[56]

While AI offers a lot of potential for monitoring sustainability commitments, it is also important to note that the application of AI must ensure the accuracy and transparency of the data it uses for analysis. If the data is inaccurate or incomplete, AI can draw false conclusions, leading to an improper assessment of countries' compliance with commitments. Furthermore, given that data from member states may contain sensitive information relating to citizens' rights, compliance with commitments in FTAs on data use must ensure that privacy rights are not violated and national security risks are minimized. In the previous section on compliance reporting mechanisms, three primary methods were discussed: (1) Independent supervisory authorities, which have the mandate to request and process data for compliance assessment; (2) International organizations, such as UNEP or ILO, which can utilize data from member states to provide an overall evaluation of compliance levels; and (3) Reports from member states, where nations self-report on their progress in implementing commitments.

In this context, legal mechanisms need to be closely developed to ensure that the use of AI in monitoring and enforcing sustainable development commitments in FTAs is effective and protects the interests of countries. AI monitoring systems must be overseen and audited by independent agencies to ensure transparency and fairness in the implementation of commitments. To address monitoring and auditing challenges moving forward, it is essential to establish international standards for AI system evaluation, implement transparent reporting mechanisms, and apply independent audit methods to detect and prevent discrepancies in the enforcement of commitments.[57] At the same time, there should be clear regulations on data ownership and security principles to protect the sensitive information of the member states.

It can be seen that AI has great potential in monitoring and assessing compliance with sustainability commitments in FTAs, helping to increase transparency, minimise errors, and improve the efficiency of the implementation of commitments. However, for AI to truly work, there must be a close combination of technology

[56] Jon Truby, *Governing Artificial Intelligence to Benefit the UN Sustainable Development Goals*, 28 SUSTAINABLE DEV. 946 (2020) [hereinafter Jon Truby].
[57] Pu Chen et al., *supra* note 42.

and legal mechanisms, ensuring that environmental, labour, and social development commitments in FTAs are implemented accurately, fairly, and effectively.

C. Assessment and forecast of compliance with sustainable development commitments

One of the key applications of AI in monitoring and enforcing sustainability commitments in FTAs is its ability to assess and predict compliance with future commitments. AI can analyse data from various sources, including national reports, environmental sensors, and satellite data, to identify compliance trends and provide accurate forecasts on the likelihood of achieving sustainability goals. Furthermore, incorporating real-life cases where AI has been successfully implemented would enhance the persuasiveness of this argument. It is also essential to clarify the specific benefits of AI in promoting the enforcement of sustainability commitments while analysing potential challenges that may arise during the adoption of this technology. Below are some practical ways AI can be deployed to support monitoring and forecasting compliance with FTA commitments:

1. Enhancing cross-border communication and information flow

AI can help standardize reporting data between countries by eliminating language barriers through automated translation and natural language processing (NLP) technology. This improves transparency and cooperation among FTA member states. For example, AI can automatically translate and aggregate reports from various countries to provide a comprehensive overview of sustainability commitment implementation. This is particularly crucial for developing countries, where reporting capabilities may be limited.

2. Automating and optimizing monitoring processes

AI can track data in real-time to detect signs of commitment violations, providing early warnings about potential issues. For example, AI models can analyse satellite emissions data to identify areas where pollution levels exceed permissible limits, thereby issuing alerts regarding potential violations of climate commitments. AI systems can also predict compliance trends based on historical data, allowing regulatory bodies to make more accurate assessments regarding the likelihood of achieving sustainability targets.

3. Optimizing resource allocation and reducing implementation cost

AI can help countries use resources more efficiently by analysing economic, social, and environmental data to propose sustainable development solutions. For instance, AI can assist businesses in optimizing supply chains to minimize waste and reduce negative environmental impacts. This not only strengthens compliance with

sustainability commitments in FTAs but also enhances economic efficiency and competitiveness among member states.

AI, especially machine learning and deep learning algorithms can analyse vast amounts of data from a variety of sources to identify factors influencing the implementation of environmental, social, and economic commitments.[58] The use of AI to forecast compliance helps countries and international organizations identify potential problems and provide information to adjust policies in a timely and effective manner.[59]

AI algorithms, such as regression analysis, classification, and deep learning, can be used to analyse factors that affect the implementation of sustainability commitments. For example, machine learning algorithms can analyse environmental data on greenhouse gas emission levels, air quality, and land degradation to assess whether countries are complying with environmental protection commitments in FTAs.[60] By using historical data on past commitments, AI can identify factors such as environmental policy, investments in clean technology, and the ability to enforce regulations, which, in turn, have a direct impact on the implementation of this commitment.[61] This is especially useful in the context that countries may face many factors that affect the ability to implement sustainable development commitments, such as changes in economic conditions, political volatility, changes in national development strategies, etc. or a shortage of financial and technological resources.[62] AI can integrate and analyse all of these factors to make predictions about future commitment compliance. These forecast models help countries grasp compliance trends and support international organisations, such as the United Nations, to take timely interventions.[63]

AI systems play a crucial role in assisting countries in identifying risk factors that may impact their ability to meet sustainability commitments. By utilizing advanced data analytics, AI can process vast amounts of macroeconomic data, environmental indicators, and compliance trends to detect potential threats. For instance, AI models can analyse fluctuations in economic growth, trade policies, and resource

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[58] Zoe Gareiou & Areti Patoucha, *The Role of Artificial Intelligence in Environmental Sustainability*, 585 E3S WEB CONF. 11011 (2024) [hereinafter Zoe Gareiou & Areti Patoucha].
[59] Etinosa Igbinenikaro & O. A. Adewusi, *supra* note 3.
[60] *Id.*
[61] Suzanne M. Richer & Jonathan Canioni, *The Role of AI and Emerging Technologies in Global Trade Compliance*, 7(1) J. SUPPLY CHAIN MGMT. LOGISTICS & PROCUREMENT 34 (2024).
[62] *Id.*
[63] Josh Cowls et al., *The AI gambit: Leveraging Artificial Intelligence to Combat Climate Change Opportunities, Challenges, and Recommendations*, 38 AI & SOC'Y 287 (2023).

availability to assess how these variables might influence a country's ability to fulfil its commitments under FTAs.

One of the key mechanisms through which AI identifies risk factors is through predictive modelling. By analysing historical compliance patterns, AI can forecast potential non-compliance scenarios based on economic downturns, environmental degradation, or policy shifts. For example, if AI detects a correlation between rising deforestation rates and economic pressures in certain industries, it can flag this as a risk factor for commitments related to biodiversity conservation. Additionally, AI can enhance risk assessment by integrating real-time environmental monitoring data with socio-economic indicators. By continuously evaluating air and water pollution levels, labour rights violations, or supply chain disruptions, AI can generate early warnings for policymakers. These insights allow governments and international organizations to take proactive measures, such as adjusting policies, allocating resources efficiently, or strengthening enforcement mechanisms. Moreover, AI can conduct sentiment analysis on public discourse, news reports, and governmental statements to gauge political and social trends that may impact compliance. If a government signals a shift away from sustainability policies due to economic concerns, AI can flag this trend and recommend targeted interventions. By integrating these various analytical approaches, AI not only helps countries assess their current compliance status but also enables them to anticipate and mitigate potential risks before they escalate into significant challenges. This proactive approach ensures that sustainability commitments under FTAs remain achievable, despite changing economic and environmental conditions. Typically, developing countries or emerging economies may face difficulties in attracting investment for environmental protection projects or sustainable development initiatives. AI can analyse macroeconomic data such as GDP growth, public investment, and financial indicators, to forecast whether these countries can maintain their sustainability commitments amid economic difficulties.[64]

By identifying these risk factors, countries can develop response strategies and adjust policies to ensure that commitments are fully implemented. A real-world example of the application of AI in forecasting compliance with sustainable development commitments is the use of UNEP's predictive models to assess the ability of member states to implement environmental commitments under global environmental agreements. For instance, UNEP's Global Environment Outlook (GEO) report provides an assessment of the global environmental situation, evaluates the effectiveness of existing policies, and forecasts future environmental trends, thereby supporting countries in fulfilling their sustainable development

[64] Assunta Di Vaio et al., *Artificial intelligence and Business Models in the Sustainable Development Goals Perspective: A Systematic Literature Review*, 121 J. BUS. RES. 283 (2020).

commitments.[65] UNEP utilizes AI algorithms to analyse emission trends, renewable energy adoption, and nature conservation indicators, offering predictive insights into the likelihood of achieving environmental sustainability goals. AI plays a crucial role in key areas such as energy management, land use optimization, and disaster response by processing vast datasets to detect patterns, forecast risks, and recommend adaptive strategies. For instance, in the energy sector, AI can enhance grid efficiency and optimize renewable energy integration, while in land use planning, it can assess deforestation risks and guide reforestation efforts. Additionally, AI-driven disaster response systems can predict extreme weather events and improve early warning mechanisms, contributing significantly to climate change mitigation and adaptation.[66] The UNEP has been at the forefront of applying AI to monitor and assess the implementation of environmental commitments by member states in FTAs and international environmental agreements. To ensure efficiency, UNEP utilizes a multi-source data collection system, incorporating satellite imagery, remote sensing data from organizations such as NASA and ESA, environmental sensor data from IoT systems, national reports, and information from non-governmental organizations and independent research.[67] AI enables UNEP to analyse real-time data to track pollution levels, deforestation, climate change, and the degree of compliance with sustainable development commitments. One of the key applications of AI is its ability to forecast non-compliance risks, helping UNEP identify high-risk areas early to implement timely interventions.[68] Additionally, AI facilitates cross-country policy effectiveness comparisons, allowing UNEP to provide policy recommendations based on real-world data.[69]

Notably, AI models can optimize resource allocation and support governments in adjusting policies to maximize efficiency in fulfilling environmental commitments. However, to ensure this model is widely accepted, UNEP must establish effective oversight mechanisms to ensure that AI operates transparently and is not subject to manipulation or misuse.[70] Along with that, UNEP can implement stringent data

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[65] UNEP, *Global Environment Outlook (GEO): Assessing the State of the Environment and Policy Effectiveness*, https://www.unep.org/geo.

[66] Dhakshina Priya Rajeswari Ilango et al., *Significance of Artificial Intelligence to Develop Mitigation Strategies Against Climate Change in Accordance with Sustainable Development Goal (Climate Action)*, in VISUALIZATION TECHNIQUES FOR CLIMATE CHANGE WITH MACHINE LEARNING AND ARTIFICIAL INTELLIGENCE 377 (2023).

[67] UNEP, *Harnessing Artificial Intelligence for the Environment* (2023).

[68] David Olawade et al., *Artificial Intelligence Potential for Net Zero Sustainability: Current Evidence and Prospects*, 4(1) NEXT SUSTAINABILITY 32, 45 (2024).

[69] Montaser Ramadan et al., *Real-time IoT-Powered AI System for Monitoring and Forecasting of Air Pollution in Industrial Environment*, 283 ECOTOXICOLOGY AND ENVIRONMENTAL SAFETY 1 (2024) [hereinafter Ramadan et al.].

[70] Marwan Al-Raeei, *The Smart Future for Sustainable Development: Artificial Intelligence Solutions for Sustainable Urbanization,* 33(1) SUSTAINABLE DEV. 508 (2024) [hereinafter Marwan].

protection standards, ensuring that AI is only permitted to collect and process environmental data without infringing on political, security, or economic information of member states.[71] Standardizing data and integrating open technology is another crucial approach, allowing countries to access and utilize data without being controlled by a third party.[72]

Moreover, international cooperation is key to ensuring the sustainability of AI-driven environmental monitoring models. This requires countries to establish common data standards, provide technological and financial support, particularly for developing nations, and foster collaborative efforts.[73] As such, AI not only enhances UNEP's monitoring effectiveness but also strengthens transparency and accountability in the implementation of sustainable development commitments.

In addition to applications in the environmental sector, AI can also be applied to forecast compliance with social commitments, especially in the areas of labour rights protection and social justice development. Machine learning algorithms can analyse data on working conditions, gender equality levels, and education quality to forecast how likely countries are to meet their social commitments. For example, analysing data on income disparities, unemployment rates, and social reports can help AI make forecasts about social development trends and the likelihood of achieving social justice goals in countries participating in FTAs.

However, ensuring accuracy and transparency in the same inputs is a major challenge when using AI to assess and forecast compliance with sustainability commitments. Incomplete or inaccurate data, coupled with biases inherent in AI models, can lead to misleading conclusions that influence policy decisions in a way that disproportionately affects developing countries. Since AI models rely on historical and real-time data, any pre-existing bias in the dataset—whether due to data gaps, regional disparities, or differing reporting standards—can result in skewed assessments. This, in turn, may place developing countries under greater scrutiny, leading to increased regulatory pressure or unjustified policy interventions. Therefore, it is essential to establish rigorous mechanisms for detecting, mitigating, and correcting biases within AI-driven monitoring systems. These mechanisms should include transparent data validation processes, diverse and representative datasets, and continuous audits to ensure that AI applications support equitable and

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[71] Aaditya Mattoo & Joshua P. Meltzer, *supra* note 5.

[72] Christopher Kuner et al., *The EU General Data Protection Regulation (GDPR): A Commentary*, 9 INT'L DATA PRIV. L. 1, 4 (2019) [hereinafter Kuner].

[73] Suresh Neethirajan, *Navigating to Net Zero: Leveraging Big Data, AI, and Benchmarking for Sustainable Climate Action and Emissions Reduction*, *ResearchGate* (2023), https://www.researchgate.net/publication/375775875.

objective policy decisions.[74] To address this issue, clear legal regulations should be established regarding the collection, processing, and sharing of data between member states. These regulations should define the scope of permissible data collection, outline transparency requirements, and establish safeguards to prevent misuse or bias in AI-driven assessments. Accordingly, countries and international organisations need to work closely together to ensure data transparency and verify the accuracy of forecast results. In addition, AI cannot completely replace the human factor in evaluating sustainability commitments.[75] While algorithms can analyse data quickly and accurately, understanding and interpreting each country's political, social, and economic context is still critical to making sound assessments and forecasts. Therefore, the use of AI in on assessing and forecasting compliance with sustainable development commitments needs to be combined with the involvement of experts, monitoring agencies, and international organisations to ensure that decisions are made an adequate and accurate basis.

The use of AI to assess and forecast compliance with sustainability commitments is an important step forward in enhancing the effectiveness of monitoring FTAs. AI can provide information for countries and international organizations to predict trends and identify potential problems early, thereby helping to adjust policies and strategies to ensure that sustainable development commitments are fully implemented. However, in order for AI to be maximally effective, it is necessary to have solid legal mechanisms, international cooperation, and the involvement of experts to ensure accuracy and fairness in the monitoring and forecasting process.

D. Artificial Intelligence and Automated Monitoring Systems

AI is rapidly proving its ability to support the monitoring and enforcement of sustainability commitments in FTAs. In particular, the ability to develop automated monitoring systems has supported member states and international organisations to monitor and report on the implementation of sustainable development commitments more effectively and accurately than ever before. These systems automate data collection and analysis help increase transparency and minimise errors in compliance reporting. Automated monitoring systems utilizing AI can address the issue of data uniformity by integrating multiple data sources, including national reports, satellites, environmental sensors, and international databases, even when member states lack sufficient infrastructure. By employing machine learning algorithms, these systems can detect data gaps, estimate missing values, and adjust inconsistencies in reporting, thereby enhancing the reliability of compliance assessments. Furthermore, AI-driven solutions can mitigate barriers to automated

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[74] Abdulaziz Aldoseri et al., *Re-Thinking Data Strategy and Integration for Artificial Intelligence: Concepts, Opportunities, and Challenges*, 13 APPLIED SCI. 12 (2023).
[75] Assunta Di Vaio et al., *supra* note 64.

data collection by leveraging alternative sources, such as remote sensing technology and predictive modelling, to compensate for missing or incomplete national data.[76] However, challenges remain in ensuring the accuracy and fairness of AI-based monitoring, as biases in the underlying data may still disproportionately impact developing countries, subjecting them to greater scrutiny. Addressing these concerns requires the development of legal and technical safeguards to standardize data collection methodologies and ensure equitable treatment across jurisdictions. AI can help identify indicators in commitments to environmental protection, labour rights, and sustainable economic development. For example, automated monitoring systems can monitor greenhouse gas emissions or air pollution levels through sensors and satellites, comparing this data to commitments in FTAs.[77] A good example is air pollution monitoring systems implemented by organisations such as the United Nations or international environmental organisations. While AI can automatically collect and analyse pollution data from major cities to monitor the level of implementation of pollution reduction commitments, its effectiveness is significantly limited by infrastructure disparities. In regions lacking sufficient monitoring capabilities, the data collected may be incomplete or inaccurate, leading to potential biases in policy assessments. Therefore, addressing these infrastructure gaps is essential to ensure that AI-driven monitoring provides a comprehensive and equitable assessment of pollution reduction efforts across all member states.[78]

The use of AI in automated monitoring systems helps to minimise errors and enhance accuracy in assessing compliance with commitments. Because, traditional monitoring can cause inconsistencies and delays in reporting from member states. Country reports may not be updated in a timely manner or may contain errors or omissions in the data. As a result, the AI-driven automated monitoring system is capable of collecting and analysing real-time data, thereby providing instant reports on the implementation of sustainability commitments.[79] This helps countries and international organisations promptly detect violations and take quick remedial measures. Moreover, AI systems can help eliminate the human element in the process of data collection and processing, minimise errors and fraud in reporting, and ensure transparency throughout the entire monitoring process.

On the other hand, developing automated monitoring systems improves the accuracy of compliance reporting and plays a crucial role in reducing costs and

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[76] Han-Wei Liu & Ching-Fu Lin, Artificial Intelligence and Global Trade Governance: A Pluralist Agenda, 61(2) HARV. INT'L L.J. 407 (2020) [hereinafter Han-Wei Liu & Ching-Fu Lin].

[77] Ramadan et al., *supra* note 69.

[78] David B. Olawade et al., *Artificial Intelligence Potential for Net Zero Sustainability: Current Evidence and Prospects*, 4 NEXT SUSTAINABILITY 1 (2024).

[79] Marwan, *supra* note 70.

increasing monitoring efficiency. AI systems can automatically analyse millions of data points without human intervention, which reduces the operational costs of supervisory agencies and enhances the ability to monitor regularly without interruption. As in monitoring environmental commitments, systems using AI can scan and analyse data from environmental sensors, satellites, and national reports to provide accurate reports on the state of the environment and progress toward its sustainability commitments.

The increase in the application of automated monitoring systems in member states of international agreements is also noteworthy. For example, within the framework of climate change agreements such as the Paris Agreement, member states have used AI tools to monitor compliance with commitments to reduce greenhouse gas emissions.[80] Organizations such as UNEP also develop automated monitoring platforms, which help track countries' environmental commitments and provide live data on progress towards the targets.[81] The system uses AI algorithms to analyse emissions data from countries and help identify countries at risk of failing to meet their environmental goals, thereby recommending timely interventions.[82] However, the implementation of automated monitoring systems faces the issue of data ownership and security. Legal mechanisms for the collection and processing of data from Member States, especially environmental and social data, should be established to ensure that the collection and processing of data in automated surveillance systems comply with the principles of confidentiality and privacy, while protecting the legitimate interests of Member States.[83]

Besides, while AI systems can help increase transparency and monitoring effectiveness, countries need to ensure that these tools do not cause discrimination or bias, or in other words, ensure fairness and global recognition of automated surveillance systems.[84] The development of automated monitoring systems must be carried out with the participation and supervision of independent international organizations, to ensure that these tools are deployed fairly and do not harm the interests of any country.

It can be seen that automated monitoring systems using AI, are an important tool to help enhance the effectiveness of monitoring and enforcing sustainability

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[80] Suresh Neethirajan, *Navigating to Net Zero: Leveraging Big Data, AI, and Benchmarking for Sustainable Climate Action and Emissions Reduction*, Preprints (Nov. 20, 2023), https://doi.org/10.20944/preprints202311.1257.v1.

[81] R SIVARETHINAMOHAN, UNLOCKING THE POTENTIAL OF (AI-POWERED) BLOCKCHAIN TECHNOLOGY IN ENVIRONMENT SUSTAINABILITY AND SOCIAL GOOD 193 (2022).

[82] *Id.*

[83] Aaditya Mattoo & Joshua P. Meltzer, *supra* note 5.

[84] Rowena Rodrigues, *supra* note 6.

commitments in FTAs. These systems help improve the accuracy and timeliness of compliance reporting, and minimise errors and monitoring costs.

IV. LEGAL ISSUES RELATED TO THE APPLICATION OF AI IN MONITORING AND ENFORCING SUSTAINABILITY COMMITMENTS

A. Data Privacy and Security

When AI is applied to monitor and enforce sustainability commitments in FTAs, it is crucial to address legal concerns related to data security and privacy. The collection, processing, and sharing of environmental and social data involve sensitive information, particularly when personal data is incorporated into AI-driven reports and analytics. This raises concerns about privacy, individual freedoms, and the risk of personal data misuse.[85]

A key challenge is the compliance burden imposed by stringent data protection regulations such as the General Data Protection Regulation (GDPR), which has set a global benchmark for data privacy laws. However, despite its comprehensive framework, GDPR presents significant compliance challenges, particularly for countries lacking adequate infrastructure to track data from creation to deletion.[86] Moreover, ambiguities regarding timelines for compliance, proportionality in data processing, and cross-border enforcement mechanisms have been widely criticized.[87] Given that FTA participants must align their policies with GDPR-like frameworks, it is essential to evaluate the limitations of this model to ensure a more adaptive and globally inclusive approach to data protection.

Privacy concerns are especially pressing in AI-driven monitoring, as the collection of environmental and labour-related data in FTAs may result in unintended surveillance risks. For instance, incorporating health, wage, or socio-economic data into AI models can expose individuals to privacy violations if such data is inadequately protected. Misuse of personal information-whether through unauthorized access, unethical data exploitation, or lack of informed consent-raises significant legal and ethical concerns.[88] Thus, the collection and processing of

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[85] Grzegorz Mazurek & Karolina Małagocka, *Perception of Privacy and Data Protection in the Context of the Development of Artificial Intelligence*, 6 J. MGMT. ANAL. 344 (2019).
[86] Oluwatosin Reis et al., *Privacy Law Challenges in the Digital Age: A Global Review of Legislation and Enforcement*, 6(1) INT'L J. APPLIED RSCH. SOC. SCI. 73 (2024).
[87] Helen Nissenbaum, *Protecting Privacy in an Information Age: The Problem of Privacy in Public*, 17 L. & POL'Y 559 (2020).
[88] Christina Tikkinen-Piri et al., *EU General Data Protection Regulation: Changes and Implications for Personal Data Collecting Companies*, 34(1) COMPUT. L. & SEC. REV. 134 (2018).

environmental and social data in AI monitoring systems must comply with robust legal safeguards to prevent violations of privacy and digital rights.

Another critical issue is data ownership and cross-border data sharing. While some jurisdictions have implemented stringent data protection regimes, others lack comprehensive frameworks or operate under less restrictive legal standards.[89] This regulatory disparity creates inconsistencies in data collection, protection, and governance. To harmonize these discrepancies, countries engaging in FTAs must establish mutually recognized data security and privacy standards, ensuring legal data exchange without compromising individual rights or sovereignty.[90] Additionally, ensuring transparency and data auditability in AI-based monitoring remains a challenge. Independent regulatory bodies and international watchdogs must oversee data processing to ensure its lawful use and prevent political or economic exploitation.

The use of AI for monitoring sustainability commitments offers new opportunities for public accountability and policy enforcement.[91] However, ensuring transparency in AI-driven monitoring reports is essential. Member states must have clear guidelines on data access and sharing protocols, preventing unauthorized surveillance or privacy breaches.

Typically, GDPR serves as a reference model for regulating personal data in AI systems. The regulation mandates that all entities collecting and processing personal data must explicitly communicate the purpose of data collection and provide mechanisms that grant individuals control over their information.[92] GDPR also enforces lawfulness, fairness, and transparency principles, requiring organizations to obtain explicit consent before data processing. This ensures that individuals can access, correct, or request deletion of their data under the 'right to be forgotten' provision.[93] Furthermore, GDPR imposes severe penalties for non-compliance, reinforcing its role as a critical legal instrument for protecting data privacy and fostering trust in AI-driven monitoring systems.

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[89] Lee A. Bygrave, *Privacy and Data Protection in an International Perspective*, 56 SCAND. STUD. L. 165 (2010).
[90] Aaditya Mattoo & Joshua P. Meltzer, *supra* note 5.
[91] Lynn Miller et al., *AI for Monitoring the Sustainable Development Goals and Supporting and Promoting Action and Policy Development*, in *2020 IEEE/ITU International Conference on Artificial Intelligence for Good (AI4G)*, https://doi.org/10.1109/AI4G50087.2020.9311014 [hereinafter Lynn Miller et al.].
[92] Paul De Hert & Vagelis Papakonstantinou, *The New General Data Protection Regulation: Still a Sound System for the Protection of Individuals?*, 34 COMPUT. L. & SECUR. REV. 179, 185 (2018).
[93] Kuner, *supra* note 72.

In conclusion, data privacy and security remain key legal challenges in AI-based monitoring of sustainability commitments in FTAs. Ensuring that data collection and processing occur lawfully, transparently, and fairly while safeguarding individual privacy is fundamental. AI-based surveillance systems should be deployed in a manner that maximizes their regulatory effectiveness while minimizing risks to individual rights and national sovereignty.

B. Compliance with international legal regulations

The application of AI in monitoring and assessing compliance with sustainability commitments in FTAs must ensure that AI tools comply with national legal regulations. Accordingly, countries participating in FTAs must ensure that the use of AI is consistent with sustainable development commitments and comply with international agreements, protects the legitimate interests of member states and does not cause violations of national sovereignty, economic, or political interests. International legal requirements for the use of AI in monitoring sustainable development commitments start with the principle of respecting national sovereignty, a fundamental principle of international law.[94] Although countries participating in FTAs agree to share information and data, this sharing of data cannot infringe on national self-determination. The application of AI in monitoring and assessing compliance with sustainability commitments in FTAs must ensure that AI tools comply with national legal regulations. Accordingly, countries participating in FTAs must ensure that the use of AI is consistent with sustainable development commitments and complies with international agreements, protects the legitimate interests of member states, and does not cause violations of national sovereignty, economic, or political interests. International legal requirements for the use of AI in monitoring sustainable development commitments start with the principle of respecting national sovereignty, a fundamental principle of international law.[95]

Although countries participating in FTAs agree to share information and data, this sharing of data cannot infringe on national self-determination. To ensure compliance, it is essential to establish clear legal frameworks and procedural safeguards that dictate how AI systems collect, store, and process data. For example, AI applications in sustainability monitoring must incorporate transparency measures, such as requiring prior consent from national authorities before accessing environmental, social, or economic data. Additionally, mechanisms should be in place to regulate the permissible scope of AI data collection, ensuring that it does not extend beyond what is necessary to assess sustainability commitments. Furthermore, AI-driven monitoring must align with national data protection

[94] Fatim Roumate, *Artificial Intelligence, Ethics and International Human Rights Law*, 29 INT'L. REV. INFO. ETHICS 1 (2020).
[95] *Id.*

regulations, particularly when handling sensitive information. This can be achieved by implementing robust encryption protocols, restricting third-party access, and ensuring that AI models do not disproportionately expose national resources or strategic interests. Countries should also develop standardized guidelines on data-sharing obligations to prevent potential conflicts regarding sovereignty and economic security. This is an important legal issue, especially when data related to environmental protection or social issues can have a major impact on internal policy and national security. For instance, if AI monitoring systems collect detailed industrial pollution data, countries may be reluctant to disclose such information due to competitive concerns. Similarly, economic data related to labour rights or trade practices must be managed carefully to prevent undue external influence over domestic policymaking. Therefore, integrating legal oversight mechanisms into AI-driven sustainability monitoring is critical to maintaining a balance between compliance, data security, and national self-determination. This is an important legal issue, especially when data related to environmental protection or social issues can have a major impact on internal policy and national security.

Besides, countries must ensure that the use of AI does not go against the international agreements signed between countries participating in FTAs. Countries can sign international agreements related to the protection of labour rights, the protection of human rights, the protection of the environment, and the maintenance of sustainable development commitments, but the implementation of AI in monitoring compliance with these commitments must strictly comply with the requirements from international agreements. This requires countries participating in FTAs to work closely with international organisations such as the United Nations, the ILO, or international environmental organisations to ensure that the use of AI does not violate international regulations and does not undermine global sustainable development goals. A clear, applicable practice of complying with international legal regulations is the development of the OECD Guidelines on the protection of personal data and the data protection provisions in the Paris Agreement on climate change. The OECD has developed a set of security and privacy protection standards for the collection, processing, and use of national data, especially when it is used in international surveillance systems.[96] These regulations ensure that countries can participate in global monitoring systems without fear of losing control of data or having their economic and political interests violated. For environmental commitments, the Paris Agreement requires countries to take measures to reduce greenhouse gas emissions and report on progress on the implementation of these commitments.[97] AI, in this case, can be used to monitor countries' compliance with

[96] Dan Svantesson, *Data Localisation Trends and Challenges: Considerations for the Review of the Privacy Guidelines* (OECD Digital Economy Papers, Working Paper No. 301, 2020).
[97] Paris Agreement, arts. 4 & 6, Dec. 12, 2015.

these commitments, but it must comply with national privacy and data protection principles outlined in international agreements.

To ensure the legitimacy of the use of AI in monitoring and assessing compliance with sustainability commitments, countries and international organisations need to develop common regulations and standards to govern the collection, processing, and use of data. Independent supervisory bodies have an essential role in checking compliance with international regulations.[98] These bodies need to have strong legal authority to ensure that AI does not violate security and privacy principles and that the data collected is used fairly and transparently. This makes sense in that member states have different data protection standards, which can create challenges in ensuring synchronisation and fairness in the use of data for international monitoring.

In addition, countries need to ensure that the use of AI does not diminish the economic and political interests of countries participating in FTAs. As it can be seen, when AI is applied in monitoring and evaluating commitments, it is possible to make conclusions or propose policy interventions that may affect national interests.[99] Therefore, countries need to ensure that international legal mechanisms protect their rights in the process, not allowing AI to cause injustice or harm national interests in strategic areas such as economic development, energy, or national security. An international practice of complying with international legal regulations in the application of AI is the development of AI regulations in international trade at organisations such as the World Trade Organization (WTO) and the United Nations.[100] These organisations have begun to develop guidelines and legal frameworks to ensure that the use of AI technology in monitoring and enforcing sustainable development commitments is implemented within a clear legal framework, protecting the legitimate interests of all participating countries.

Thus, ensuring that the application of AI in monitoring and implementing sustainable development commitments does not infringe upon the interests of FTA participating countries and complies with international agreements is a necessary legal factor to protect national interests and support the implementation of sustainable development commitments in FTAs.

C. Ensure fairness and transparency in AI monitoring

When AI is used to monitor compliance with sustainability commitments in FTAs, it is necessary to ensure fairness and transparency in the monitoring process. AI can

[98] Pierre Thielbörger, *supra* note 32.
[99] Abdulaziz Aldoseri et al, *supra* note 74.
[100] Marta Soprana, Governing Artificial Intelligence: The Role of International Trade Law (2022) (Ph.D. dissertation, Universita' Commerciale Luigi Bocconi).

be highly effective in data processing and analysis, however if not carefully controlled, the application of AI can lead to biased, unfair or discriminatory outcomes, especially in monitoring sustainability commitments where the evaluation needs to be fair and not influenced by external factors.[101] Accordingly, AI can generate unfair or biased conclusions due to the algorithms used. AI algorithms, while powerful, can still reflect existing biases in the data they are trained on. For example, suppose an AI system is trained on data from countries that have made good sustainability commitments but lacks data from countries with less developed economies. In that case, the AI system may underestimate its ability to comply with commitments from these countries, despite other factors such as lack of resources or specific circumstances. This can lead to discrimination or inaccurate assessments, affecting the fairness of the monitoring process.

In addition, the problem of bias in the use of AI can also appear in the selection and analysis of data elements.[102] For example, environmental indicators analysed by AI systems may not be complete or reflect the reality of factors affecting the environment in developed and developing countries. This can make monitoring of environmental protection commitments not implemented accurately and fairly. Without safeguards in place, countries participating in FTAs may struggle to ensure that their commitments are assessed fairly and are not biased by data that is incomplete or not representative of their actual situation.[103] Therefore, it is necessary to build clear legal mechanisms for testing and regulating AI systems in order to ensure that these monitoring tools operate fairly and without causing injustice. An important solution is to establish independent testing mechanisms for AI monitoring results. Oversight bodies such as international organizations or agencies in each country should have the power to examine and evaluate the results of AI oversight, determining whether algorithms cause bias or not by their work.[104] These agencies can also examine the data that AI uses to determine if there are any biases or biases in data collection and processing.

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[101] George Benneh Mensah, *Artificial Intelligence and Ethics: a Comprehensive Review of Bias Mitigation, Transparency, and Accountability in AI Systems*, 1 AFR. J. FOR REGULATORY AFFAIRS 32 (2024).

[102] Drew Roselli et al., *Managing Bias in AI*, ASS'N FOR COMPUTING MACHINERY (May 13, 2019), https://dl.acm.org/doi/10.1145/3308560.3317590.

[103] *Id.*

[104] Ryan Federo & Angel Saz-Carranza, *A Typology of Board Design for Highly Effective Monitoring in Intergovernmental Organizations Under the United Nations System*, 14 REGULATION & GOVERNANCE 344 (2020).

A notable practice is the establishment of independent monitoring bodies within the framework of international organizations such as the United Nations and UNEP[105]. These organizations have an essential role in ensuring that AI monitoring systems comply with international regulations on sustainability and protect fairness and transparency. Within the framework of the Paris Agreement on climate change, UNEP has coordinated with environmental organizations and member countries to monitor the implementation of commitments to reduce greenhouse gas emissions and use AI tools to monitor environmental indicators, ensuring that countries comply with their commitments in a fair manner and are not affected by biased factors.[106]

In addition, to ensure transparency in monitoring and assessing compliance with commitments, member states have established reporting disclosure systems to share AI monitoring results with the international community. These reports should be publicly and easily accessible, so that stakeholders, including international organizations, civil society organizations, and the general public, can check and verify the accuracy and fairness of monitoring results. Member states also need to have legal provisions in place to ensure that supervisory bodies and national bodies can participate in testing, modifying, and improving AI monitoring systems if any deviations or biases are detected. Along with that, the establishment of international standards for AI monitoring also plays an important role. International organizations such as the United Nations and the World Trade Organization have a role to play in developing and harmonizing these standards, ensuring that all countries participating in FTAs apply the same AI monitoring processes and methods.[107] The standards may include requirements for privacy protection, data security, and the prevention of any discrimination during monitoring and evaluation. Typically, the development of the EU's automated monitoring system for the implementation of sustainable development commitments in member states.[108] The system, which uses AI tools to monitor environmental and social indicators, is designed to ensure fairness and transparency. AI monitoring reports are publicly available and can be independently audited by international agencies, thereby increasing confidence in the process of enforcing commitments.

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[105] United Nations Environment Programme, Understanding Our Evaluation Function, UNEP Evaluation Office (2023), https://www.unep.org/evaluation-office/understanding-our-evaluation-function.

[106] United Nations Environment Programme, *How Artificial Intelligence is Helping Tackle Environmental Challenges*, (Nov. 7, 2022), https://www.unep.org/news-and-stories/story/how-artificial-intelligence-helping-tackle-environmental-challenges.

[107] Joshua P Meltzer, *supra* note 7.

[108] Mariola Grzebyk & Małgorzata Stec, *Sustainable development in EU Countries: Concept and Rating of Levels of Development*, 23 SUSTAINABLE DEV. 110 (2015).

Thus, to ensure fairness and transparency in monitoring sustainable development commitments using AI, countries and international organisations need to establish independent audit mechanisms, develop clear international standards, and make monitoring reports public. This will help protect the interests of countries participating in FTAs ensure that AI monitoring tools work fairly, do not cause discrimination, and ensure transparency in the implementation of sustainable development commitments.

V. ENFORCEMENT STRATEGIES AND LEGAL RECOMMENDATIONS

A. Develop a legal mechanism to support the application of artificial intelligence in the supervision of free trade agreements

The application of AI in monitoring and enforcing sustainability commitments in FTAs brings great benefits in enhancing transparency, minimising errors, and improving the effectiveness of the implementation of commitments.[109] However, to ensure the effectiveness of the application of this technology, it is necessary to develop appropriate and solid legal mechanisms, both at the national and international levels. These mechanisms must ensure that the use of AI does not violate national interests, protect privacy, and maintain fairness in monitoring compliance with sustainable development commitments.[110]

First, the basic element of building a legal mechanism is the clear definition of the rights and obligations of countries, international organisations and stakeholders in the use of AI in monitoring.[111] States need to commit to cooperation in the sharing of data and information and to protect the interests of their countries and citizens. This requires the development of international agreements on data security and common privacy protection standards, to ensure that the collection and use of data does not harm national interests or the rights of individuals. These regulations need to be mandatory, creating a consistent legal framework for countries participating in FTAs. In addition, to facilitate the application of AI in monitoring sustainable development commitments, countries need to have mechanisms to allow the use of this technology legally and effectively.[112] This includes the development of laws and regulations regarding the collection, processing, and sharing of data, as well as regulations on the protection of personal information and sensitive data. The

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[109] Zoe Gareiou & Areti Patoucha, *supra* note 58.

[110] Natalia Díaz Rodríguez et al., *Connecting the Dots in Trustworthy Artificial Intelligence: From AI Principles, Ethics, and Key Requirements to Responsible AI Systems and Regulation*, 99 INFO. FUSION 51, 51–71 (2023).

[111] Saniyat Agamagomedova et al., *Artificial Intelligence in the Control and Supervisory Activities of the State: Current Trends*, in TECHNOLOGICAL TRENDS IN THE AI ECONOMY: INTERNATIONAL REVIEW AND WAYS OF ADAPTATION 256 (2023).

[112] JAEMIN LEE, ARTIFICIAL INTELLIGENCE AND INTERNATIONAL LAW (2022).

development of these mechanisms must be done with care, ensuring that there is no contradiction between national legal requirements and international obligations to which the countries participating in FTAs have committed.

Second, to facilitate the application of AI in monitoring and implementing sustainable development commitments, countries and international organisations need to strengthen international cooperation.[113] The partnership facilitates data sharing, which includes technology training, research, and development initiatives, as well as technical assistance to help countries, especially developing countries, take advantage of AI technology.[114] One of the major challenges in applying artificial intelligence to monitoring sustainable development commitments is the disparity in access to technology between developed and developing countries. The development and deployment of AI systems require significant financial resources, advanced technical infrastructure, and highly skilled personnel. In this context, international cooperation plays a crucial role in bridging the technology gap, ensuring that all countries have equitable access to AI for monitoring environmental and sustainable development commitments. Countries can support each other through AI training programs, the provision of shared technological platforms for implementing monitoring systems, and the exchange of best practices in applying technology to track compliance with sustainable development commitments. International experience has demonstrated that cooperation among nations in utilizing AI for monitoring sustainable development commitments has yielded positive results, particularly through bilateral and multilateral initiatives aimed at ensuring fair access to new technologies for developing countries.[115] However, if developing countries do not build their own AI models, they will become dependent on AI systems provided by developed countries, which could lead to data colonization," where developing countries lack autonomy in managing and using their own data.[116] This not only impacts fairness in monitoring sustainable development but also raises legal challenges related to data sovereignty, personal data protection, and the right to access information. Therefore, alongside promoting international cooperation in AI development, there must be appropriate policies to ensure that technology transfer and AI access are conducted fairly, respect the data sovereignty of each nation, and do not lead to excessive dependence on foreign technological platforms. This can be achieved through multilateral trade agreements on green technology transfer, collaborative initiatives within the framework of the United Nations, and AI capacity-building programs in developing countries. Organisations such as UNEP and the United Nations have played an important role

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[113] Adebola Folorunso et al., *A Policy Framework on AI Usage in Developing Countries and its Impact*, 21(1) GLOB. J. ENG. TECH. 154 (2024).
[114] *Id.*
[115] OECD, *International Cooperation in AI and Sustainable Development* (2022).
[116] UNCTAD, *Digital Economy Report: Data Sovereignty and AI* (2023).

in developing cooperation mechanisms and technical assistance for countries participating in the agreement.[117] Thereby, the sharing of technology, data and monitoring methods has helped countries to develop advanced monitoring systems, thereby improving their ability to monitor and enforce environmental commitments.

Third, to create an effective legal mechanism for the use of AI in monitoring FTAs, countries need to work together to develop international legal standards for the collection, processing, and sharing of surveillance data. International organisations may have a central responsibility in coordinating these initiatives, setting global standards for security and privacy in the use of AI, and protecting the interests of member states.[118] The development of these standards will help create a synchronous, fair and transparent monitoring system that ensures that the monitoring and implementation of sustainable development commitments is effective and does not harm the interests of participating countries. In fact, the development of security and privacy standards in the field of AI is an indispensable part of promoting international cooperation.[119] Countries need a legal mechanism to monitor the implementation of these standards and ensure that all activities that use AI in monitoring sustainability commitments comply with international legal principles.[120] This requires an international consensus on data security and privacy issues, and at the same time ensures that cross-border data sharing does not harm national interests or individual interests.

It can be seen that in order to support the application of AI in monitoring and implementing sustainable development commitments in FTAs, it is necessary to build solid international and national legal mechanisms. Countries and international organisations need to work closely together in developing common legal standards, facilitating the legal and equitable use of AI, and ensuring that AI monitoring tools protect the interests of participating countries and meet signed sustainable development commitments.

B. Recommendations on protection of national interests and compliance with international regulations

The use of AI can have many benefits in improving transparency, minimising errors, and improving monitoring efficiency, but it can also pose risks if not carefully managed.[121] Therefore, countries participating in FTAs need to ensure that the

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[117] Jean-Baptiste et al., *supra* note 11.

[118] Tareq AL-Billeh et al., *The Risks of Using Artificial Intelligence on Privacy and Human Rights: Unifying Global Standards*, 31 J. LEGAL MEDIA 333 (2024).

[119] *Id.*

[120] Jon Truby, *supra* note 56.

[121] Matthew U. Scherer, *Regulating Artificial Intelligence Systems: Risks, Challenges, Competencies, and Strategies*, 29(2) HARV. J.L. & TECH. 353 (2015) [hereinafter Matthew U. Scherer].

application of AI in monitoring their commitment to sustainable development does not infringe on their economic, political, or national security interests.

First, to protect national interests, it is necessary to develop regulations on data sovereignty. While AI can be beneficial in monitoring and analysing sustainability commitments, data sharing and collection between countries should be done with caution.[122] Sensitive data related to the environment, society, and even a country's economic data may contain strategic or confidential information that countries do not want to share. As a result, countries need to establish legal barriers to protect ownership and control over their data, and ensure that the data is only used for legitimate surveillance purposes and is not misused.

Second, to avoid violating national interests when using AI in surveillance, it is necessary to have independent inspection and monitoring mechanisms. Independent watchdogs can be international organisations, government agencies, or NGOs that have the authority to evaluate AI surveillance activities, ensuring that the use of AI does not harm the interests of countries.[123] This independent supervisory body can carry out inspections, check compliance with commitments, verify monitoring reports, and ensure that data is collected and used in a fair, transparent, and lawful manner. Furthermore, there should be feedback and complaint mechanisms for countries participating in FTAs, so that they can request adjustments or modifications in the monitoring systems if any infringement on their rights is detected.

Third, international legal standards play an essential role in ensuring the legitimacy and effectiveness of AI surveillance systems.[124] Countries need to establish clear international legal regulations and standards to regulate the collection, processing, and sharing of data within the framework of FTAs. This standard can be based on personal data protection and information security principles such as the European Union's GDPR.[125] Such standards contribute to protecting the privacy of individuals and establishing transparent requirements for the collection, storage, and processing of personal data, especially in the context of automated monitoring systems using AI. Countries participating in FTAs need to jointly develop these international legal standards to ensure that the use of AI complies with sustainable development commitments and protects the legitimate rights and interests of each country.

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[122] Grzegorz Mazurek & Karolina Małagocka, *supra* note 85.
[123] Gracia Marín Durán, *supra* note 26.
[124] Rachid Ejjami, *AI-Driven Justice: Evaluating the Impact of Artificial Intelligence on Legal Systems*, 6(3) INT'L. J. MULTIDISCIPLINARY RSCH. 1 (2024).
[125] Chris Hoofnagle et al., *The European Union General Data Protection Regulation: What It Is and What It Means*, 28(1) INFO. & COMMC'N. TECH. L. 65 (2019).

Fourth, countries also need to develop national monitoring systems to ensure that the implementation of commitments relies on the supervision of international organisations. The national monitoring system will help countries to proactively monitor and evaluate the progress of their sustainability commitments, and ensure that international AI monitoring systems do not infringe on national interests.[126] One of the notable practices is the development of automated government monitoring and reporting systems in FTAs member countries, helping them comply with commitments and control factors influencing internal policy. In addition, states need to have the right to participate in international mechanisms for monitoring and assessing compliance with commitments without fear that the data will be used for improper purposes or infringe on national sovereignty.[127] This requires countries to participate in international forums to discuss and agree on standards for the use of AI in monitoring sustainable development commitments. Countries also need to be provided with tools to check and protest when there are violations in the use of data and the application of AI.

Fifth, in order for the application of AI not to violate national interests, it is necessary to develop dispute resolution mechanisms when there are conflicts between countries about the use of data and AI applications. These mechanisms should be established in the form of international arbitration bodies or international courts specializing in the resolution of trade and environmental disputes, in order to ensure that countries can resolve legal conflicts arising from the use of AI without harming international relations.[128]

Ensuring that the application of AI in monitoring and enforcing sustainable development commitments does not violate national interests requires countries to develop and harmonize clear and fair international legal standards. Monitoring mechanisms, cooperation between countries and international organizations, and data and privacy protection regulations will be essential to protect national interests and ensure that sustainable development commitments are implemented effectively and equitably.

C. Strengthening international cooperation in the application of artificial intelligence

The application of AI in monitoring and assessing compliance with sustainable development commitments in FTAs requires strong and synchronous international cooperation. AI is capable of processing and analysing large volumes of data from a variety of sources, however, to ensure effectiveness in monitoring compliance with

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[126] Steven Feldstein, The Global Expansion of AI Surveillance, Carnegie Endowment for Int'l Peace, at 9 (2019) [hereinafter Steven Feldstein].
[127] George Charles Alter & Mary Vardigan, *supra* note 8.
[128] Matthew U. Scherer, *supra* note 121.

commitments, countries, and international organisations need to build solid cooperation platforms.[129] As a result, countries need to collaborate to develop and deploy AI monitoring tools, and share data and information on compliance with sustainability commitments. This helps ensure accuracy and transparency in monitoring, thereby creating a strong and fair global monitoring system.

First, it is necessary to build global cooperation mechanisms to develop AI monitoring tools. FTAs member states can cooperate with each other and with international organisations to develop AI surveillance technology platforms.[130] International bodies such as the United Nations, UNEP, the World Trade Organization, and labour rights organisations can play an integral role in coordinating and providing common technical and legal standards for the implementation of AI in monitoring sustainable development commitments.[131] This collaboration will help countries share resources and technologies, especially when developed countries are capable of providing advanced technologies, while developing countries can leverage these solutions to improve their ability to monitor and enforce their commitments.

Second, to monitor compliance with sustainable development commitments, data sharing between countries is essential. In this regard, the development of international data security standards is necessary to ensure that data is shared transparently, securely and legally. Countries need to agree on basic principles for data collection, sharing, and use, and ensure that the information shared does not infringe on economic, political, or national security interests.[132] A good example is the implementation of the United Nations' Global Greenhouse Gas Emissions Monitoring System, where countries share data on CO2 emission levels and other environmental indicators, helping to monitor compliance with environmental protection commitments.[133]

Third, international cooperation can also be promoted through public-private partnership models in the development and deployment of AI monitoring tools. Countries can collaborate with research institutions, technology companies, and civil society organisations to develop AI monitoring tools tailored to each country's needs while ensuring fairness and transparency in enforcement. The public-private model will help create innovative and sustainable solutions and ensure that AI monitoring tools are deployed effectively, protecting the interests of all stakeholders. In fact,

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[129] Pierre Thielbörger, *supra* note 32.
[130] Han-Wei Liu & Ching-Fu Lin, *supra* note 76.
[131] Lynn Miller et al., *supra* note 91.
[132] Steven Feldstein, *supra* note 126.
[133] Matthias Jonas et al., *Quantifying Greenhouse Gas Emissions*, 24 MITIGATION & ADAPTATION STRATEGIES GLOB. CHANGE 839 (2019) [hereinafter Matthias Jonas et al.].

many countries have begun to implement public-private partnership initiatives to build and develop AI monitoring systems in areas such as environmental protection, labour rights monitoring, and the enforcement of social commitments. For example, within the framework of global environmental protection initiatives, organisations such as UNEP have partnered with technology companies to deploy AI monitoring tools that help track the implementation of countries' environmental commitments.[134]

Fourth, to ensure that the use of AI in monitoring and enforcing sustainability commitments needs to be legitimate and effective, countries need to establish evaluation and feedback mechanisms. These mechanisms will help countries and international organisations evaluate the effectiveness of AI monitoring tools in monitoring and promoting compliance with commitments. Not only must this review system be transparent and fair, but it also needs to have a mechanism in place to handle complaints from countries if they feel that the use of AI is unfair or harms their rights. The development of these mechanisms can refer to the evaluation and response models of other international organisations, such as the World Health Organization (WHO) or the WTO, in monitoring and evaluating compliance with global regulations. A prominent international practice in international cooperation in monitoring and assessing compliance with commitments is the United Nations Global Greenhouse Gas Emissions Monitoring System.[135] This system helps countries share data on greenhouse gas emissions which, at the same time, creates a collaborative platform for countries to jointly assess and monitor environmental protection commitments. This mechanism has helped to increase transparency and effectiveness in monitoring the implementation of commitments to reduce global greenhouse gas emissions.

Strengthening international cooperation in the application of AI to monitor and implement sustainable development commitments in FTAs requires close cooperation between countries, international organisations and stakeholders. It is necessary to build data security mechanisms, develop public-private partnership models, and establish evaluation and feedback systems to ensure that AI monitoring tools are not only effective but also fair and transparent. This will help ensure that AI can maximise its potential in promoting compliance with sustainable development commitments without compromising national interests and complying with international legal regulations.

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[134] Jonathan Awewomom et al., *Addressing Global Environmental Pollution Using Environmental Control Techniques: A Focus on Environmental Policy and Preventive Environmental Management*, 2 DISCOVER ENV'T 8 (2024).

[135] Matthias Jonas et al., *supra* note 133.

VI. CONCLUSION

AI offers benefits in monitoring and ensuring compliance with sustainability commitments in FTAs. The use of AI contributes to increasing transparency and minimising errors in the process of assessing compliance with commitments to environmental protection, labour rights, and sustainable economic development. In addition, AI also helps countries reduce monitoring costs and enhance automated monitoring capabilities, thereby improving efficiency in ensuring that commitments are fulfilled on time. However, the application of AI also poses many legal challenges such as issues of data security, privacy and protection of national interests, data collection, processing, and sharing within the framework of FTAs, ensuring that AI systems do not cause discrimination or bias in assessing compliance with the is a big challenge.

To optimise the use of AI in monitoring compliance with sustainable development commitments, countries and international organisations need to develop a comprehensive and flexible legal framework that includes international standards for data collection, processing, and sharing, along with mechanisms for responding to and handling violations or disputes, thereby contributing to effectively protecting the interests of member states. This would ensure that AI monitoring tools do not infringe on national privacy and sovereignty, as they must comply with international data security principles. The development of data security and privacy standards is a prerequisite for safe and lawful data sharing and use between countries, and an independent audit mechanism and an international cooperation model will help protect fairness and transparency in the monitoring process, ensuring that every country is evaluated fairly. Establishing these mechanisms will help strengthen international cooperation and protect the interests of countries participating in FTAs, thereby promoting global sustainable development.