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RECONCILING TRADE AND ENVIRONMENTAL PROTECTION IN WTO LAW: ADJUDICATION, FRAGMENTATION, AND REGULATORY SPACE

RAFAEL LEAL-ARCAS,* AMANI ALBAQSHI,** & HAIFA ALBELAIHID†

This article examines how World Trade Organization (WTO) adjudication shapes the balance between trade liberalisation and environmental protection by reconceptualising the notion of regulatory space in conditions of legal fragmentation. While existing scholarship treats fragmentation as an external constraint on the WTO, this article argues that fragmentation is actively mediated through adjudicative reasoning, particularly in the interpretation of Article XX of the General Agreement on Tariffs and Trade (GATT). Drawing on a systematic analysis of WTO jurisprudence, it demonstrates that panels and the Appellate Body (AB) do not merely apply fixed legal standards but recalibrate regulatory space through doctrines such as necessity, even-handedness, and proportionality. This produces a patterned but under-theorised outcome: environmental measures are more likely to be constrained where they impose asymmetric externalities on trading partners, revealing an implicit hierarchy between trade and environmental objectives. By advancing a structured analytical framework linking adjudication, fragmentation, and regulatory space, the article offers a more precise account of how legal reasoning translates into distributive consequences. It concludes by outlining doctrinal and institutional reforms, including a more deferential approach to environmental measures and a recalibration of the necessity test, to better accommodate environmental protection within the WTO legal order.

* Jean Monnet Chaired Professor in EU International Economic Law (awarded by the European Commission) & Professor of Law and Public Policy, Alfaisal University College of Law and International Relations, Riyadh, Saudi Arabia. Member, Madrid Bar Association; Ph.D., European University Institute; M. Res., European University Institute; J.S.M., Stanford Law School; LL.M., Columbia Law School; M.Phil., London School of Economics and Political Science. The author may be contacted at [r.leal-arcas\[at\]outlook.com](mailto:r.leal-arcas[at]outlook.com).

** Independent researcher.

† Independent researcher.

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I. INTRODUCTION

This Article makes three contributions. First, it reconceptualises fragmentation as an internal feature of WTO adjudication rather than an external regime conflict. Second, it demonstrates that regulatory space is constructed through adjudicative techniques rather than predefined legal boundaries. Third, it shows that WTO law manages, rather than resolves, the trade–environment tension.

The question of how GATT Article XX accommodates environmental protection has taken on renewed urgency in light of the proliferation of climate-related trade measures. The structure and interpretation of Article XX systematically constrains environmental regulation in ways that cannot be resolved through existing doctrinal tools. The coherence of WTO law depends not on resolving normative conflicts, but on sustaining them within a flexible interpretative framework. We offer a novel conceptual framework that explains why WTO adjudicators tend to constrain environmental regulatory space when cases involve asymmetries in economic power. This article conceptualises regulatory space as a function of (i) interpretive methodology in WTO adjudication and (ii) the degree of normative fragmentation between trade and environmental regimes. Existing accounts treat fragmentation as a structural problem; however, this article shows that fragmentation is actively constructed through adjudicative techniques.

Global trade law and global environmental law are two different systems of international regulation that have been shaped according to different goals, institutional forms, and normative priorities. The multilateral trading system, which has been institutionalised through the WTO, is aimed at minimisation of barriers to trade, market access, predictability, and non-discrimination. By comparison, international environmental law has developed with a disjointed system of multilateral environmental agreements, soft-law rules,¹ and new climate standards to safeguard the ecosystems, natural resources, and control transboundary environmental hazards.² These regimes were running somewhat parallel with each other in the twentieth century. Over the last few decades, though, the interaction

¹ R. Leal-Arcas & L. Carafa, *Road to Paris COP21: Towards soft global governance for climate change?*, 5(2) RENEWABLE ENERGY L. & POL'Y REV. 130 (2014).

² DAVID BODANSKY, *THE ART AND CRAFT OF INTERNATIONAL ENVIRONMENTAL LAW* 18–36 (2010).

between them has been deepening, with states becoming more prone to environmental policies,³ seeing a direct impact on international trade.⁴

This interaction has especially become consequential in the 2020s. Fast global warming, loss of biodiversity, deforestation, and pollution have put governments in a situation that has never been experienced before, demanding them to regulate production, consumption, and global supply chains. Regulation of the environment has also assumed trade-relevant measures, such as carbon border adjustment measures,⁵ due-diligence requirements of a sustainability nature, product specifications, labelling systems, and measures involving animal welfare or resource conservation.⁶ Although such efforts aim at achieving legitimate environmental goals, there is a high risk of contradicting the fundamental trade commitments of non-discrimination, access to the market, and absence of quantitative restrictions. The contribution by the WTO judicial bodies in this context will be of central concern in explaining the way through which states balance trade liberalisation and environmental protection. This paper contends that, even though the WTO Panels and the AB have made considerable interventions in this reconciliation by interpreting the law, their contribution is limited and they act within a trade-centred paradigm.⁷

The conflict between trade and environmental regimes is indicative of more profound structural attributes of modern world governance. There is no formal precedence between specialised regimes in international law. International trade law, environmental law, human rights law, and investment law are the functionally differentiated systems that have their own institutions and mechanisms of implementation.⁸ In the situation where environmental measures inhibit trade, there are no conflicts solved based on a greater norm. Rather, they are negotiated through interpretation in the concerned institutional forum. This is done in the WTO under Panels and the AB.

³ R. LEAL-ARCAS, CLIMATE CHANGE AND INTERNATIONAL TRADE 18–24 (2013).

⁴ Piet Eeckhout, *Conflict of Norms in Public International Law: How WTO Law Relates to Other Rules of International Law*, 8 J. INT'L ECON. L. 583 (2005).

⁵ R. Leal-Arcas & Manuliza Faktaufon, *EU Trade Policy and Climate Change: The case for a Carbon Border Adjustment Mechanism*, in OXFORD ENCYCLOPEDIA OF EU LAW 1 (2025).

⁶ WTO Plurilaterals, *Multi-Party Interim Appeal Arbitration Arrangement (MPLA)*, GENEVA TRADE PLATFORM (June 09, 2021), https://wtoplurilaterals.info/plural_initiative/thempia/.

⁷ Martti Koskenniemi & Päivi Leino, *Fragmentation of International Law? Postmodern Anxieties*, 15(1) LEIDEN J. INT'L L. 553 (2002).

⁸ Gabrielle Marceau, *A Call for Coherence in International Law: Praises for the Prohibition against "Clinical Isolation" in WTO Dispute Settlement*, 33(5) J. WORLD TRADE 87 (1999).

The nature of disputes settlement system increases the impact of WTO adjudication. WTO choices become enforceable on WTO member states once made, and failure to comply could lead to approved retaliation. The inconsistent results can thus enable a change in legislation, regulatory design, and future policy decisions. Additionally, WTO jurisprudence is *de facto* precedent because Panels commonly appeal to previous AB decisions to achieve consistency and predictability.⁹ Its previous reports still remain used to structure legal argumentation even after the paralysis of the AB in 2019. In that regard, the WTO judicial bodies are not only dispute resolvers, but also institutions that distribute regulatory space between the economy and the environment.

This institutional task has been intensified by the fact that states are challenged by the need to balance trade policy and the goals of climate and sustainability. The carbon border adjustments, deforestation-free supply-chain policies, renewable energy subsidy policies, and the import restrictions of biodiversity-related restrictions are likely to bring about conflicts that push the boundaries of WTO law.¹⁰ To evaluate the ability of international law to respond to environmental crisis, it is hence important to understand how judicial bodies influence, permit, or limit such responses.¹¹

Against this background, this paper asks the following questions—to what extent do WTO Panels and the AB shape the balance between trade liberalisation and environmental protection in international law? Why is the reconciliation framework between trade and environmental protection conceptually flawed? The phrasing “to what extent” is critical. It requires an evaluation not only of the influence exercised by WTO judicial bodies, but also of the limits of that influence. The question demands an assessment of judicial doctrine, institutional design, and practical impact. It also requires attention to how adjudicative reasoning affects the normative relationship between trade law and environmental law, both within and beyond the WTO framework.¹²

The role of WTO judicial institutions in comprehending the meaning of globalisation at a time when the importance of environmental regulation is

⁹ Richard B. Stewart, *International Trade and Environment: Lessons from the Federal Experience*, 49(4) WASH. & LEE L. REV. 1329 (1992).

¹⁰ R. Leal-Arcas & A. Filis, *Renewable energy disputes in the World Trade Organization*, 13(3) OIL, GAS & ENERGY L. J. 1 (2015); R. Leal-Arcas & A. Filis, *Legal Aspects of the Promotion of Renewable Energy within the EU and in Relation to the EU's Obligations in the WTO*, 5(1) RENEWABLE ENERGY L. & POL'Y REV. 3 (2014).

¹¹ Vienna Convention on the Law of Treaties, May 23, 1969, 1155 U.N.T.S. 331 [hereinafter VCLT].

¹² Appellate Body Report, *United States — Import Prohibition of Certain Shrimp and Shrimp Products*, WTO Doc. WT/DS58/AB/R (adopted Nov. 06, 1998) [hereinafter US — Shrimp].

increasingly likely to intertwine with international trade is paramount. With the implementation of climate-related trade instruments by WTO states to achieve the decarbonisation targets and sustainability goals, adjudicators will be faced with controversies that challenge the boundaries of the legal frameworks.¹³ With no superiority established among the regimes, WTO judicial forums are key in ensuring that environmental urgency is converted into terms that are trade compliant. Their interpretations have an impact on regulatory autonomy, drafting of domestic laws and the coherence of international governance. As environmental measures generate greater transboundary trade effects, WTO adjudicators subject them to closer scrutiny to ensure that Members retain regulatory autonomy while preventing arbitrary or unjustifiable discrimination against trading partners.¹⁴

In the context of this paper, the term ‘judicial bodies’ means mainly WTO Panels and the AB that have been established in the context of the Understanding on Rules and Procedures Governing the Settlement of Disputes. Due to the paralysis of the AB since 2019, the Multi-Party Interim Appeal Arbitration Arrangement (MPIA),¹⁵ is mentioned in the context of a provisional system of appellate review among the Members of the WTO. Even though the AB is not copied in the MPIA, its presence is pertinent to the interpretation of the modern institutional environment and the survival of the appeal logic.¹⁶ Moreover, the balance between trade and the environment (which is discussed in Part III) does not mean equal weight of trade and environmental goals. Instead, it is a term of how this legal doctrine and adjudicative reasoning distributes regulatory space between trade liberalisation and environmental protection. This distribution is made using the interpretation of core obligations, exceptions, and disciplines of when environmental measures are acceptable, how they are to be formulated, and in what circumstances they can be justified.¹⁷

The term international law broadens the area of scrutiny of WTO law in smaller senses. It encompasses the engagement of WTO jurisprudence and multilateral environmental arrangements, the interpretive applicability of general principles of

¹³ R. Leal-Arcas, *Unilateral Trade-related Climate Change Measures*, 13(6) THE J. WORLD INV. & TRADE 875 (2012).

¹⁴ Aaron Cosbey & Petros C. Mavroidis, *Heavy Fuel: Trade and Environment in the GATT/WTO Case Law*, 23(3) REV. EUR., COMP. & INT’L ENV’T. L. 288 (2014).

¹⁵ A coalition of WTO Members created the Multi-Party Interim Appeal Arbitration Arrangement (MPIA) under Article 25 of the DSU. See WTO, *Alternative Dispute Resolution Procedures*, https://www.wto.org/english/tratop_e/dispu_e/altds_e.htm.

¹⁶ Appellate Body Report, *Brazil — Measures Affecting Imports of Retreaded Tyres*, WTO Doc. WT/DS332/AB/R (adopted Dec. 17, 2007) [hereinafter *Brazil — Retreaded Tyres*].

¹⁷ Appellate Body Report, *European Communities — Measures Prohibiting the Importation and Marketing of Seal Products*, WTO Doc. WT/DS400/AB/R, WT/DS401/AB/R (adopted June 18, 2014) [hereinafter *EC — Seal Products*].

international law and the larger regime framework under which trade and environmental norms co-exist. Although WTO adjudicating institutions have no formal power to amend or override external legal frameworks, these interpretations can have an impact on the way in which states respond to international environmental commitments, as well as the way states walk the fine line between commitments.¹⁸ In this paper, the term ‘influence’ will be applied to denote to what extent WTO judicial reasoning influences legal doctrine, the scope of regulatory space in environmental measures, and the influence on state behaviour and policy design beyond particular disputes.¹⁹ Regulatory space in WTO law is not pre-defined but is actively constructed through adjudicative interpretation, particularly through the proportionality-like analysis embedded in Article XX jurisprudence. We argue that Article XX functions less as an exception than as a site of adjudicative balancing, where environmental protection is conditionally accommodated through a structured yet indeterminate necessity analysis.

This paper argues that the apparent balance between trade liberalisation and environmental protection in WTO law is not a doctrinal equilibrium but a product of adjudicative strategies that selectively expand and constrain regulatory space. Through their interpretation of the GATT, particularly Article XX, and the disciplines of the Sanitary and Phytosanitary Measures and Technical Barriers to Trade Agreements, Panels and the AB have legitimised environmental objectives as valid regulatory aims and clarified the conditions under which trade-restrictive environmental measures may be justified. At the same time, their influence is constrained by the trade-centred structure of WTO law, the narrow framing of exceptions, and institutional limits arising from the AB’s paralysis. As a result, WTO adjudicatory bodies shape the equilibrium largely through nuanced doctrinal interpretation and procedural oversight, rather than by undertaking a fundamental re-conceptualisation of the relationship between international trade and environmental law.

This article adopts a critical doctrinal approach, combining legal interpretation with a governance-oriented analysis of how Article XX operates in practice under conditions of scientific uncertainty and regulatory conflict. Article XX is a structurally constrained justification mechanism that is ill-suited to govern the long-term environmental risks under uncertainty. The paper will use doctrinal legal analysis, which will address the rationale of WTO Panels and the AB in terms of evaluating the extent and the boundaries of their impact on the balance of trade and environment. The central evidentiary foundation of this study is case law, evaluated

¹⁸ MARGARET A YOUNG, REGIME INTERACTION IN INTERNATIONAL LAW: FACING FRAGMENTATION 85, 91–98 (2012).

¹⁹ Fuad Zarbiyev, *Judicial Activism in International Law: A Conceptual Framework for Analysis*, 3(2) J. INT’L DISP. SETTLEMENT 247 (2012).

in light of the applicable treaty framework and established principles of interpretation. Adopting an institutional perspective further enriches the doctrinal analysis by approximating the operation of judicial power within a member-driven WTO, where its authority is both structured and circumscribed by political constraints.

The paper unfolds in the following manner—after this introduction, Part II provides the conceptual and legal frameworks of trade liberalisation and protection of the environment. Part III provides a typology of WTO adjudicative approaches to environmental measures. Part IV considers cross-cutting doctrines that bar regulatory space. Part V takes into consideration the impact of WTO jurisprudence on international environmental law and global governance and evaluates the general scope of judicial influence. Part VI concludes, whereas Part VII offers a research agenda for international trade governance.

II. CONCEPTUAL AND LEGAL FRAMEWORK

This Part discusses the conceptual and doctrinal underpinnings required to determine how far WTO judicial institutions drive the compromise between trade liberalisation and environmental protection in international law. It begins by describing the foundations of international trade law and international environmental law and justifying why the interaction between the two creates structural tension, as opposed to hierarchy resolution. It then looks at the main WTO accords that regulate the environmental aspects of trade, with a particular interest in the way such legal texts empower and limit the regulation of the environment. Lastly, it contextualises WTO law in the context of multilateral environmental agreements (MEAs) and general international law, both of which place special emphasis on the interpretative power of systemic integration.

A. Trade Liberalisation vs. Environmental Protection in International Law

International trade law is organised such that it has a few foundational principles that are aimed at liberalising trade and avoiding discriminative or protectionist state practices. These principles include Most Favoured Nation (MFN) duty (GATT Article I), National Treatment (GATT Article III), and the ban on quantitative restrictions (GATT Article XI). The principle of MFN also means that WTO Members must spread any trade advantage that they give to any of their trading partners, to all the rest, and avoid any selective or favourable treatment given to one foreign state over another. Under national treatment, the imported goods that enter the domestic market should be treated in the country that imported those goods no worse than similar goods of the domestic country. Further, the general prohibition against quantitative restrictions restricts the application of quotas, bans, and other non-tariff products that have a direct restriction on trade movements. Collectively,

these principles aim to provide predictability, access to the market, as well as competitive neutrality in the multilateral trading system.²⁰

These fundamental commitments imprison environmental policies that touch trade in the structure of its framework. Environmental regulations tend to distinguish products or producers according to environmental factors such as their environment and construction, or their sustainability. This kind of distinction runs the risk of breaking non-discrimination regulations, in which case it ends up with less favourable treatment of goods imported or of goods whose origin is from certain countries. This has led trade law to allow environmental regulation only in strictly delimited boundaries, opening such regulations to review aimed at preventing the disguised protectionism. Although environmental goals are identified as legitimate, the WTO legal system demands that any action must be transparent, non-arbitrary, and explicable by certain legal exemptions.²¹

In comparison, international environmental law has emerged with a different normative set of principles, which focus on environmental protection and long-term sustainability. Sustainable development aims to combine economic development with environmental conservation and equity between generations. The precautionary principle still favours preventive regulation in cases where there exists the risk of severe environmental damage, despite the absence of complete scientific confidence. the Common but Differentiated Responsibilities principle acknowledges that states have an equal role to play in protecting the environment but take different capacities and historical roles that contribute to the undoing of the environment. The no-harm principle commits states to ensure that the activities in their jurisdiction do not damage the environment of other states or the areas outside the national jurisdiction.²² With these principles being combined, a normative justification of regulatory intervention, including measures having incidental restraint of trade, is obtained.

The interaction between trade law and environmental law does not exist in a formal hierarchy. Rather, it is a manifestation of the wider disintegration of international law, where regimes of specialisation develop separately and have dissimilar regulatory goals.²³ International trade law is liberalisation-oriented, market

²⁰ Leonardo Munhoz, *New Environmental Restrictions and Its Impacts in International Trade: Evolution of Environmental principles as sources of International Law*, 33(3) EUR. ENERGY & ENV'T L. REV. 123 (2024).

²¹ Tana Johnson, *Information Revelation and Structural Supremacy: The WTO's Incorporation of Environmental Policy*, 10(2) REV. INT'L ORGS. 207 (2015).

²² PHILIPPE SANDS ET AL., PRINCIPLES OF INTERNATIONAL ENVIRONMENTAL LAW 195-200 (2021).

²³ Even within a specific segment of international law, there is fragmentation. See R. Leal-Arcas, *The Fragmentation of International Trade Law: Is Now the Time for Variable Geometry?*, 12(2)

integration-oriented, legal certainty-oriented, whereas the environmental law is ecological protection-oriented, risk-management-oriented, and global common goods-oriented. The automatic precedence of one regime over another is not used as a solution to conflicts where environmental measures are involved in trade. Instead, they are resolved by being mediated, negotiated, and adjudicated within institutional procedures like the WTO dispute settlement system.²⁴

Fragmentation within WTO law is not merely external (i.e., between regimes) but internal, as adjudicators reconcile conflicting norms through flexible interpretation of GATT Article XX, thereby preserving systemic coherence at the expense of doctrinal clarity. Trade-related measures are commonly used to fulfil the purposes of environmental regimes, although measures of trade law are used to curb economic discrimination. This interaction has been characterised by scholars as a kind of normative contestation, whereby parallel legal systems co-exist without hierarchical management and has to be continuously handled through interpretation, as opposed to being resolved once and for all.²⁵ In that regard, WTO courts are at the centre of their negotiation between conflicting ends, defining the ways in which environmental protection can be accommodated in a trade-focused jurisprudence.

B. *World Trade Organization Agreements Relevant to Environmental Protection*

1. Core GATT Obligations

The GATT contains the legal benchmarks within which trade in goods is regulated and acts as the main source of restrictions to environmental interventions in the sphere of trade. The protection against discriminatory or restrictive trade policy is strongly assumed by Article I (MFN treatment), Article III (National Treatment), and Article XI (elimination of quantitative restrictions). Where environmental laws restrict imports, discriminate on the basis of origin, or impose total bans, they engage core GATT disciplines and must be defended within the narrow scope of its general exceptions.²⁶ The requirements do not forbid environmental regulation as such but the regulation must be formulated in such a way that it is non-discriminatory and

J. WORLD INV. & TRADE 145 (2011); R. Leal-Arcas & A. Filis, *The Fragmented Governance of the Global Energy Economy: A Legal-Institutional Analysis*, 6(4) J. WORLD ENERGY L. AND BUSINESS 348 (2013).

²⁴ Aaron Cosbey & Petros C Mavroidis, *Heavy Fuel: Trade and Environment in the GATT/WTO Case Law*, 23(3) REV. EUR. COMP. & INT'L ENV'T. L. 288 (2014).

²⁵ Karen Alter & Kal Raustiala, *The Rise of International Regime Complexity*, 14 ANN. REV. L. & SOC. SCI. 329 (2018), <https://www.annualreviews.org/content/journals/10.1146/annurev-lawsocsci-101317-030830>.

²⁶ Winston Ka-Ming Mak, *Sustainability of International Trade Law: The Legality of Unilateral Trade Measures for Environmental Protection in the GATT/WTO Framework*, 6(2) INT'L J. GREEN ECON. 117 (2012).

proportionate.²⁷ Consequently, the states that intend to work towards achieving environmental goals must develop measures that should adhere to the fundamental GATT provisions or can be justified in terms of the general exceptions. Such legal framework establishes a regulatory space where environmental protection is allowed, but only within the strictly limited parameters of legal examination.²⁸

2. GATT Article XX: General Exceptions

Article XX of the GATT is the key legal point of entry under which WTO Members can explain the trade-restrictive measures they have taken on the basis of environmental or other public policy. It gives the opportunity to justify measures that would otherwise be in violation of GATT obligations under certain exceptions, although there are strict conditions to be met.

WTO adjudicators have construed the structure of Article XX to be a two-tier test. To begin with, the measure should be within one of the listed exceptions, e.g., Article XX(b), which refers to steps needed to protect human, animal, or plant life or health, or Article XX(g), which refers to steps needed for the protection of exhaustible natural resources.²⁹ Second, the measure must meet the demands of the chapeau that disallows arbitrary or otherwise explainable discrimination coupled with concealed limitations on international trade.³⁰

Articles XX(b) and XX(g) support various forms of environmental goals. Article XX(b) deals with the safeguarding of life and health and should include a necessity test, which involves an evaluation of the role of the measure to the end, its trade-restrictiveness, and the existence of trade-restrictiveness alternatives. Article XX(g) covers conservation goals and demands a significant correlation between the measure and the conservation goal, even-handed use, and domestic restrictions. Both clauses authorise the regulation of the environment, though only in the case

²⁷ R. Leal-Arcas et al., *The Principle of Proportionality in International Law* 16-18 (NCCR Trade Regulation, Working Paper No. 2012/38, Dec. 2012).

²⁸ Sanford Gaines, *The WTO's Reading of the GATT Article XX Chapeau: A Disguised Restriction on Environmental Measures*, 22(4) U. PA. J. INT'L L. 739 (2001).

²⁹ E. Abu Gosh & R. Leal-Arcas, *The Conservation of Exhaustible Natural Resources in the GATT and WTO: Implications for the Conservation of Oil Resources*, 14(3) J. WORLD INV. & TRADE 480 (2013); R. Leal-Arcas & E. Abu Gosh, *Energy Trade as a Special Sector in the WTO: Unique Features, Unprecedented Challenges and Unresolved Issues*, 6(1) INDIAN J. INT'L ECON. L. 1 (2014).

³⁰ David Sifonios, *The General Exceptions Provision*, in ENVIRONMENTAL PROCESS AND PRODUCTION METHODS (PPMs) IN WTO LAW 157 (2018).

when there is an explicit nexus between the action and the objective formulated in it.³¹

The chapeau of Article XX operates as the GATT's principal safeguard against abuse. It ensures that measures provisionally justified under a specific exception are not implemented in a manner that results in arbitrary or unjustifiable discrimination or disguised protectionism. The chapeau is the aspect that moves the emphasis of the given purpose of a measure to its practical use wherein flexibility, consistency, and respect to various regulatory conditions are to be considered across the states. By so doing, the chapeau maintains regulatory independence but protects the integrity of the multilateral trading system.³²

3. Agreement on the Application of Sanitary and Phytosanitary Measures and Agreement on Technical Barriers to Trade

In addition to the GATT, there is the Agreement on the Application of Sanitary and Phytosanitary Measures (SPS) and the Agreement on Technical Barriers to Trade (TBT) that are important to organise the trade-environment interface. Both agreements acknowledge environmental protection and health protection as valid policy objectives and subject to procedural and evidentiary disciplines that ensure that the inadvertent hindrances to trade do not exist. The SPS Agreement is relevant to the actions directed at the defence of human, animal or plant life or health against certain risks. It demands that the measures should be scientifically founded and backed up by risk assessment, but tentative measures can be taken in areas where there is not enough scientific evidence. Such a science-based methodology constrains the range of precautionary regulation, placing a significant evidentiary burden on states that want to justify trade-restrictive health or environmental protection measures.³³

The TBT Agreement is extended to environmental product requirements and labelling schemes, as well as any other technical regulations and standards. It provides that such measures should have a legitimate purpose and not be more restrictive to trade than is needed to attain that purpose. Although the TBT Agreement is more flexible than the SPS Agreement, as it considers an expanded set

³¹ Giulia Claudia Leonelli, *Environmental Unilateralism and the Chapeau of Article XX GATT: The "Line of Equilibrium" and the Question of "Differently Situated" Countries*, 57(5) J. WORLD TRADE 709 (2023).

³² Marianna B Karttunen, *The Legal Principles Applying to Domestic Regulations under the SPS and TBT Agreements: Finding a Balance between Regulatory Autonomy and Free Trade*, in TRANSPARENCY IN THE WTO SPS AND TBT AGREEMENTS: THE REAL JEWEL IN THE CROWN 23 (2020).

³³ Ravi Soopramanien, *Never For-GATT: What Recent TBT Decisions Reveal about the Appellate Body's Analysis of Environmental Regulation under the WTO Agreements*, 17(1) SUSTAINABLE DEV. L. & POL'Y 4 (2016).

of justifications, it also exposes environmental regulation to necessity and non-discrimination tests, limiting regulatory autonomy.³⁴ Collectively, the GATT, SPS, and TBT Agreements bring an element of legal environment that is both facilitating and restrictive to the regulatory space on environmental protection. Environmental measures are allowed, but only when they meet strict procedural, evidentiary, and non-discriminatory conditions. This framework puts WTO judicial organs in the vanguard of the trade-off of the setting of environmental goals against trade liberalisation promises.

C. Relationship With Multilateral Environmental Agreements and General International Law

WTO law exists in a wider framework of public international law and assumes interactions with multilateral environmental treatment, including the Convention on International Trade in Endangered Species (CITES), the Montreal Protocol, the Convention on Biological Diversity, and the Paris Climate Agreement. Such contracts tend to be based on the trade-related action on the enforcement of environmental obligations, which can possibly be in conflict with the WTO disciplines. WTO agreements, however, do not create a hierarchy of deference towards MEAs and no blanket exemption of MEA-based measures is provided by WTO agreements.³⁵

Rather, it is the principles of interpretation and institutional cooperation that control the relation between WTO law and MEAs. At the national level, states are advised to integrate trade and environmental policies to reduce conflict. On the global scale, WTO committees, like the Committee on Trade and Environment, offer arenas of discussion and exchange of information. Although there is a constant fear of a potential chilling effect on environmental regulation, pragmatically, there is still accommodation, but not a fundamental conflict in the system of the two components, according to practice, with a degree of accommodation at the national level.³⁶

General international law contributes to this type of accommodation by the principle of systemic integration, which is found in Article 31(3)(c) of the Vienna Convention on the Law of Treaties (VCLT). The provision stipulates that treaty interpreters must

³⁴ Robyn Eckersley, *The Big Chill: The WTO and Multilateral Environmental Agreements*, 4(2) GLOBAL ENV'T POL. 24 (2004).

³⁵ DUNCAN BRACK & KEVIN GRAY, MULTILATERAL ENVIRONMENTAL AGREEMENTS AND THE WTO 16–17 (2003).

³⁶ JOOST PAUWELYN, CONFLICT OF NORMS IN PUBLIC INTERNATIONAL LAW: HOW WTO LAW RELATES TO OTHER RULES OF INTERNATIONAL LAW 445–452 (2003) [hereinafter Pauwelyn].

also consider some rules of international law that exist between the parties during the interpretation of treaty obligations. This principle has been applied by WTO adjudicators to recognise the applicability of environmental norms to interpret WTO provisions without permitting environmental norms to alter or repeal WTO commitments.³⁷

This legal pluralism is a moderate one as portrayed by this interpretative approach. Judicial organs of the WTO acknowledge that the WTO agreements are part of a broader system of international law, but the autonomy of WTO law and its primacy remain a part of their mandate.³⁸ Rather than operating as independent constraints, external norms serve as interpretive context within WTO adjudication. This approach preserves the trade-oriented architecture of the WTO while enabling modest, though carefully circumscribed, interaction with environmental law.³⁹ The outcome is the selective integration of environmental standards in WTO adjudication. The judicial impact is exerted by interpretation and not transformation, which influences the way environmental goals are to be realised into the prevailing trade disciplines without fundamentally redefining trade and environmental law issues. This is the framework that is core to the consideration of the degree of influence that the WTO judicial bodies have.

III. A TYPOLOGY OF WTO ADJUDICATIVE APPROACHES TO ENVIRONMENTAL MEASURES

To move beyond descriptive accounts of WTO jurisprudence, this article develops a typology of adjudicative approaches to environmental measures. This typology enables a shift from case-by-case doctrinal analysis to a generalisable understanding of how adjudication structures regulatory space under conditions of legal fragmentation. Rather than treating WTO case law as reflecting a single, coherent balancing methodology, the analysis demonstrates that adjudicators operate through distinct modes of review that systematically structure the scope of regulatory space under conditions of legal fragmentation. The typology distinguishes between four ideal-type adjudicative modes—deferential, conditional, restrictive, and fragmented. These modes vary along three dimensions—(i) the intensity of review under the necessity test and the chapeau of Article XX; (ii) the weight accorded to environmental objectives; and (iii) the extent to which adjudication accommodates or suppresses normative fragmentation between trade and environmental regimes.

³⁷ Ernst-Ulrich Petersmann, *Economic Disintegration? Political, Economic, and Legal Drivers and the Need for "Greening Embedded Trade Liberalism"*, 23(2) J. INT'L ECON. L. 347 (2020).

³⁸ Gabrielle Marceau, *WTO Dispute Settlement and Human Rights*, 13(4) EUR. J. INT'L L. 753 (2002).

³⁹ Pauwelyn, *Supra* note 36.

Table 1: Summarises these modes and their defining characteristics

Adjudicative Mode	Level of Regulatory Space	Key Legal Tests Applied	Treatment of Environmental Objective	Typical Conditions	Illustrative WTO Cases	Implications for Trade–Environment Balance
Deferential Mode	High	Flexible necessity test; contextual interpretation of chapeau; proportionality-sensitive	Environmental objective given substantial weight; precautionary logic tolerated	Measure addresses global/transboundary harm; evidence reasonably supports policy; less discriminatory design	<i>Brazil — Retreaded Tyres</i> ; <i>EC — Asbestos</i>	Expands regulatory autonomy; allows states to prioritise environmental protection even with trade restrictions
Conditional Deference	Moderate	Structured necessity test; strict scrutiny of alternatives; even-handed	Environmental objective recognised but balanced tightly against	Measures are partially discriminatory or inconsistently applied; less viable trade-restrictive	<i>US — Shrimp</i> (<i>Article 21.5</i>); <i>US — Tuna II</i>	Regulatory space preserved but contingent on design and consistency;

		ness emphasized	trade impact	alternatives identified	(Mexico)	incentivises careful policy calibration
Restrictive Mode	Low	Strict necessity test; narrow reading of exceptions; formal application of chapeau	Environmental objective subordinated to trade discipline; scepticism toward justification	High trade restrictiveness; significant asymmetric externalities imposed on trading partners; weak justification or inconsistent application	US — <i>Gasoline</i> ; <i>China</i> — <i>Rare Earths</i>	Constrains environmental regulation; reinforces primacy of trade liberalisation
Fragmented/Conflict Mode	Variable/Unstable	Inconsistent or competing interpretations across agreements or cases	Environmental objectives mediated through competing legal regimes (e.g., MEAs vs WTO rules)	Overlap between WTO law and external environmental regimes; lack of clear hierarchy or coordination	EC — <i>Biotech</i> ; tensions with MEA-related disputes	Produces legal uncertainty; regulatory space depends on how fragmentation is resolved in adjudication

WTO adjudication does not apply a uniform balancing approach, but instead operates through distinct modes that systematically vary with the distribution of trade costs and the design of environmental measures.

A. Deferential Mode: Expansive Regulatory Space

In the deferential mode, WTO adjudicators adopt a relatively flexible approach to the necessity test and interpret the chapeau of Article XX in a contextual and purposive manner. Environmental objectives are afforded substantial weight, and adjudicators display a willingness to accommodate regulatory diversity, particularly where measures address transboundary or global environmental harms. Cases such as *Brazil — Retreaded Tyres* and *EC — Asbestos* illustrate this approach.⁴⁰ In these disputes, the adjudicative bodies accepted that environmental and public health objectives could justify significant trade restrictions, provided that the measures were supported by plausible evidence and were not applied in an arbitrarily discriminatory manner. The result is an expansion of regulatory space, allowing states to prioritise environmental protection even at the expense of trade liberalisation.

B. Conditional Deference: Calibrated Balancing

The conditional deference mode reflects a more structured and calibrated form of review. Here, adjudicators recognise the legitimacy of environmental objectives but subject measures to rigorous scrutiny, particularly with respect to the availability of less trade-restrictive alternatives and the requirement of even-handedness. This approach is evident in disputes such as *US — Shrimp (Article 21.5)* and *US — Tuna II (Mexico)*.⁴¹ In these cases, environmental measures were not rejected outright but were required to meet demanding conditions relating to design, flexibility, and non-discrimination. Regulatory space is thus preserved, but only on the condition that states carefully calibrate their policies to minimise trade distortions. This mode incentivises regulatory refinement but also constrains policy autonomy by imposing significant justificatory burdens.

C. Restrictive Mode: Constrained Regulatory Space

In the restrictive mode, WTO adjudication adopts a narrow interpretation of Article XX exceptions, applying the necessity test stringently and reading the chapeau in a

⁴⁰ *Brazil — Retreaded Tyres*, *supra* note 16; Appellate Body Report, *European Communities — Measures Affecting Asbestos and Asbestos-Containing Products*, WTO Doc. WT/DS135/AB/R (adopted Apr. 5, 2001) [hereinafter *EC — Asbestos*].

⁴¹ *US — Shrimp*, *supra* note 12; Appellate Body Report, *United States — Measures Concerning the Importation, Marketing and Sale of Tuna and Tuna Products*, WTO Doc. WT/DS381/AB/R (adopted June 13, 2012) [hereinafter *US — Tuna II (Mexico)*].

formalistic manner. Environmental objectives are effectively subordinated to trade disciplines, particularly where measures impose significant costs on trading partners. Early jurisprudence, such as *US — Gasoline*, as well as later disputes like *China — Rare Earths*,⁴² exemplify this approach. In these cases, adjudicators emphasised the trade-restrictive effects of environmental measures and scrutinised inconsistencies in their application, leading to findings of WTO inconsistency. The result is a contraction of regulatory space and a reinforcement of trade liberalisation as the dominant normative objective.

D. Fragmented Mode: Instability under Legal Pluralism

Finally, the fragmented mode captures situations in which WTO adjudication is shaped by tensions between overlapping legal regimes, such as multilateral environmental agreements and WTO rules. In this mode, outcomes are less predictable, as adjudicators must navigate competing normative frameworks without a clear hierarchy. Disputes such as *EC — Biotech*,⁴³ illustrate how fragmentation generates legal uncertainty, with adjudicative reasoning reflecting unresolved tensions between trade obligations and external environmental commitments. Regulatory space in this mode is variable and contingent, depending on how adjudicators reconcile—or fail to reconcile—these competing norms.

E. Explaining Variation Across Adjudicative Modes

The typology reveals that WTO adjudication does not reflect a uniform balancing exercise but instead exhibits patterned variation. In particular, the analysis suggests that the level of regulatory space afforded to environmental measures is shaped by three interrelated factors—(i) the degree of trade restrictiveness; (ii) the distribution of economic costs between domestic and foreign actors; and (iii) the presence of supporting international environmental norms. Environmental measures that impose asymmetric externalities on trading partners are more likely to trigger restrictive or conditionally deferential modes of review, whereas measures addressing widely recognised global harms are more likely to be treated deferentially. In this sense, adjudication does not merely apply legal rules but actively mediates the distributional consequences of regulatory choices under conditions of fragmentation.

⁴² Appellate Body Report, *China — Rare Earths*, WTO Doc. WT/DS431/AB/R, WT/DS432/AB/R, and WT/DS433/AB/R (adopted Aug. 29, 2014) [hereinafter *China — Rare Earths*]; Appellate Body Report, *United States — Standards for Reformulated and Conventional Gasoline*, WTO Doc. WT/DS2/AB/R (adopted May 20, 1996) [hereinafter *US — Gasoline*].

⁴³ Panel Report, *European Communities — Measures Affecting the Approval and Marketing of Biotech Products*, WTO Doc. WT/DS291/R, WT/DS292/R, and WT/DS293/R (adopted Nov. 21, 2006).

F. *Implications for the Trade–Environment Interface*

By identifying distinct adjudicative modes, this typology provides a more precise account of how WTO law structures the relationship between trade and environmental protection. It shows that regulatory space is not fixed but is continuously recalibrated through legal reasoning, with significant implications for the design and viability of environmental measures. This insight forms the basis for the policy implications developed in the following Part, which argue for a recalibration of adjudicative standards to better accommodate environmental objectives within the WTO legal framework.

IV. CROSS-CUTTING DOCTRINES SHAPING THE BALANCE BETWEEN TRADE AND THE ENVIRONMENT

Doctrines developed by WTO adjudicators determine in practice how much regulatory space WTO members enjoy when they adopt environmental measures that affect trade. Panels and the AB interpret open-textured treaty terms such as “necessary”, “no more trade-restrictive than necessary”, “arbitrary or unjustifiable discrimination”, “like products”, and “based on” a risk assessment in the GATT, TBT, and SPS.⁴⁴ Through these interpretations, they convert general obligations into detailed tests. Those tests recognise environmental protection as a legitimate objective, yet demand strict justification and non-discrimination, as the core trade–environment jurisprudence shows.⁴⁵ The cumulative effect is a balance that permits robust environmental regulation, but only when WTO members satisfy dense, judicially elaborated conditions.

A. *Necessity and “no more trade-restrictive than necessary”*

Necessity functions as a central gateway for environmental measures under GATT Article XX and related provisions.⁴⁶ Article XX(b) permits measures “necessary to protect human, animal or plant life or health,” while Article XX(a) and (d) use the same formula for public morals and for the enforcement of domestic laws; similar necessity language appears in GATS Article XIV and in TBT Article 2.2, which requires that technical regulations should not be more trade-restrictive than

⁴⁴ Marrakesh Agreement Establishing the World Trade Organization, Apr. 15, 1994, 1867 U.N.T.S. 154, annex 1A, General Agreement on Tariffs and Trade 1994 art. XX [hereinafter GATT 1994]; annex 1A, Agreement on Technical Barriers to Trade arts. 2.1–2.2 [hereinafter TBT Agreement]; annex 1A, Agreement on the Application of Sanitary and Phytosanitary Measures art. 5 [hereinafter SPS Agreement].

⁴⁵ US — Shrimp, *supra* note 12; US — Gasoline, *supra* note 42; EC — Asbestos, *supra* note 40; EC — Seal Products, *supra* note 17.

⁴⁶ GATT 1994, *supra* note 44, art. XX.

necessary to achieve legitimate objectives, including the protection of life, health and the environment.⁴⁷ The AB in *Korea — Beef* treated “necessary” as a standard that requires “weighing and balancing” several factors including the importance of the interests at stake, the measure’s contribution to those interests, the degree of trade restriction, and the availability of reasonably available alternatives that achieve the same level of protection.⁴⁸ Later reports in *US — Gambling* and *Brazil — Retreaded Tyres* endorsed and refined this approach in both GATT and GATS contexts.⁴⁹ In *Brazil — Retreaded Tyres*, the AB accepted that a highly trade-restrictive import ban could still qualify as “necessary” under Article XX(b) because it made a material contribution to reducing the health and environmental risks posed by waste tyres and because Brazil had no reasonably available alternative that delivered its chosen level of protection.⁵⁰

Under the TBT Agreement, panels and the AB apply a related but distinct test under Article 2.2.⁵¹ In *US — Tuna II (Mexico)* and *US — Certain Country of Origin Labelling (COOL) Requirements*, the AB examined the measure’s objective, the degree of contribution, the extent of trade restrictiveness, and possible alternative measures that would achieve the same level of protection with lower trade impact.⁵² The AB underlined that Article 2.2 does not prohibit trade-restrictive measures as such, but only measures that are more trade-restrictive than necessary in light of their objectives and the risks of non-fulfilment.⁵³ The necessity and Article 2.2 tests, therefore, provide significant space for environmental measures where the objective is important and the measure contributes meaningfully to that objective. At the same time, these doctrines constrain regulation by obliging WTO members to justify their policy choices against concrete alternatives and to demonstrate contribution through evidence or reasoned projections, burdens that can be particularly heavy for WTO members with limited administrative capacity.

⁴⁷ GATT 1994, *supra* note 44, art. XX(a), (b), (d); Marrakesh Agreement Establishing the World Trade Organization, annex 1B, General Agreement on Trade in Services art XIV; TBT Agreement, *supra* note 44, art. 2.2.

⁴⁸ Appellate Body Report, *Korea — Measures Affecting Imports of Fresh, Chilled and Frozen Beef*, WTO Doc. WT/DS161/AB/R and WT/DS169/AB/R (adopted Jan. 10, 2001) [hereinafter *Korea — Beef*].

⁴⁹ Appellate Body Report, *United States — Measures Affecting the Cross-Border Supply of Gambling and Betting Services*, WTO Doc. WT/DS285/AB/R (adopted Apr. 20, 2005) [hereinafter *US — Gambling*]; *Brazil — Retreaded Tyres*, *supra* note 16.

⁵⁰ *Brazil — Retreaded Tyres*, *supra* note 16.

⁵¹ TBT Agreement, *supra* note 44, art. 2.2.

⁵² *US — Tuna II (Mexico)*, *supra* note 41; Appellate Body Report, *United States — Certain Country of Origin Labelling (COOL) Requirements*, WTO Doc. WT/DS384/AB/R and WT/DS386/AB/R (adopted July 23 2012), [hereinafter *US — COOL*].

⁵³ *Id.*

B. *Non-discrimination and “even-handedness”*

Non-discrimination remains the core organising principle of the multilateral trading system and acts as a powerful filter for environmental regulation.⁵⁴ GATT Articles I and III prohibit discrimination between like imported products from different members and between imported and domestic like products.⁵⁵ The chapeau of Article XX requires that measures provisionally justified under one of the enumerated exceptions must not be applied in a manner that constitutes arbitrary or unjustifiable discrimination between countries where the same conditions prevail, or a disguised restriction on international trade.⁵⁶

Early trade–environment disputes already used the chapeau to manage this balance.⁵⁷ In *US — Gasoline* and *US — Shrimp*, the AB accepted that environmental protection and conservation fit within Article XX, but held that the way in which the United States applied its measures produced arbitrary or unjustifiable discrimination.⁵⁸ The reasoning focused on process rather than outcome: insufficient flexibility, unequal treatment of exporters in different regions, and a lack of good-faith efforts at cooperation undermined the legitimacy of the measures.⁵⁹ The chapeau thus emerged as a device that preserves WTO members’ right to regulate while policing discriminatory implementation. Moreover, in *US — Shrimp*, the AB reframed the dispute from a conflict between trade and environmental protection into one of procedural fairness, thereby avoiding a direct hierarchy between the two values.⁶⁰ This illustrates how WTO adjudication manages normative conflict through proceduralisation, rather than substantive prioritisation.

The non-discrimination disciplines in TBT Article 2.1 performs a similar function. In *US — Clove Cigarettes*, *US — Tuna II (Mexico)*, and *US — COOL*, the AB examined whether detrimental effects on imports flowed exclusively from legitimate regulatory distinctions or reflected discrimination against imported products.⁶¹ The AB introduced the language of “even-handedness” to describe the requirement that a measure treat imported and domestic products in a balanced way, having regard to its design, architecture, and revealing structure.⁶² In *EC — Seal Products*, the AB

⁵⁴ GATT 1994, *supra* note 44, arts. I & III.

⁵⁵ *Id.*

⁵⁶ GATT 1994, *supra* note 44, art. XX chapeau.

⁵⁷ *US — Gasoline*, *supra* note 42; *US — Shrimp*, *supra* note 12.

⁵⁸ *Id.*

⁵⁹ *Id.*

⁶⁰ *US — Shrimp*, *supra* note 12, at ¶ 158–186.

⁶¹ Appellate Body Report, *United States — Measures Affecting the Production and Sale of Clove Cigarettes*, WTO Doc. WT/DS406/AB/R (adopted Apr. 24, 2012) [hereinafter *US — Clove Cigarettes*]; *US — Tuna II (Mexico)*, *supra* note 41; *US — COOL*, *supra* note 52.

⁶² *US — Clove Cigarettes*, *supra* note 61; *US — Tuna II (Mexico)*, *supra* note 41.

accepted that animal welfare falls under public morals and that a ban on seal products could be justified under GATT Article XX(a), but it found discrimination where the design and operation of exceptions for certain hunts undermined the measure's coherence and even-handedness.⁶³

These strands of case law protect against disguised protectionism and encourage environmental measures that apply in a fair and consistent manner across products and suppliers.⁶⁴ At the same time, strict scrutiny of even-handedness makes it harder to design measures that target specific high-impact commodities, producers, or countries, forcing WTO members that wish to tackle particular environmental harms to frame instruments in more general, origin-neutral terms or to invest heavily in justifying any apparent asymmetry.

C. *Material contribution and proportionality-type reasoning*

Contribution requirements and proportionality-type reasoning add another layer of discipline.⁶⁵ The AB has held that a measure need not secure full achievement of its objective to qualify as “necessary”, but the measure must make a material, and not merely marginal, contribution.⁶⁶ In *Brazil — Retreaded Tyres*, the AB accepted that the import ban formed part of a broader policy to manage waste tyres and that the ban reduced the accumulation of such waste, even though other domestic sources remained significant.⁶⁷ The AB assessed the measure's effectiveness, internal inconsistencies such as exemptions, and the overall regulatory context in a single inquiry.⁶⁸ Similar reasoning appears in *Korea — Beef* and *US — Gambling*, where the AB balanced the degree of contribution against the measure's trade restrictiveness and the availability of alternatives.⁶⁹ Panels and the AB ask whether the measure's benefits for health or the environment justify its costs in terms of trade restriction, given the range of other tools that might be used.

For environmental regulation, contribution and proportionality-type analysis have two faces. On one side, they push WTO members to design coherent measures that genuinely pursue environmental objectives and avoid internal contradictions that undercut claimed benefits. On the other side, they require increasingly sophisticated evidence or modelling to establish non-trivial environmental gains. Complex

⁶³ EC — Seal Products, *supra* note 17.

⁶⁴ US — Clove Cigarettes, *supra* note 61; US — Tuna II (Mexico), *supra* note 41; US — COOL, *supra* note 52; EC — Seal Products, *supra* note 17.

⁶⁵ Korea — Beef, *supra* note 48; US — Gambling, *supra* note 49; Brazil — Retreaded Tyres, *supra* note 16.

⁶⁶ Brazil — Retreaded Tyres, *supra* note 16; Korea — Beef, *supra* note 48.

⁶⁷ Brazil — Retreaded Tyres, *supra* note 16.

⁶⁸ *Id.*

⁶⁹ Korea — Beef, *supra* note 48; US — Gambling, *supra* note 49.

challenges such as climate change and biodiversity loss involve extended causal chains and uncertain effects, making it difficult to demonstrate a material contribution. While the doctrine thus encourages serious and evidence-based policymaking, it may also discourage innovative or experimental measures whose benefits are not readily quantifiable *ex ante*.

D. Likeness and process-and-production methods

Likeness doctrine decides when non-discrimination rules apply and, as a result, whether WTO members may differentiate between products on environmental grounds. GATT practice identifies several criteria for assessing likeness, including physical properties, end-uses, consumers' tastes and habits, and tariff classification.⁷⁰ In *EC — Asbestos*, the AB confirmed these criteria and held that health risks may inform both physical similarity and consumer perception.⁷¹ The AB concluded that asbestos-containing construction materials were not "like" certain asbestos-free substitutes because the lethal health risks associated with asbestos produced a fundamental difference in the products' characteristics and in consumer behaviour.⁷²

EC — Asbestos opened the door for regulators to treat products as unlike where health or environmental risks diverge, even when other characteristics look similar. Later disputes tested how far that logic extends to process-and-production methods (PPMs).⁷³ In *US — Tuna II (Mexico)*, the AB examined a "dolphin-safe" label linked to fishing techniques and the risk they pose to dolphins.⁷⁴ The dispute arose under the TBT Agreement rather than GATT Article III, yet the reasoning accepted that distinctions based on production processes may reflect legitimate environmental concerns, provided the measure does not discriminate unjustifiably among like products.⁷⁵ In *US — Shrimp*, the AB accepted a measure that conditioned market access for shrimp on the use of turtle-excluder devices in trawling operations, subject to the constraints of the Article XX chapeau.⁷⁶ The AB criticised the original application of the measure as discriminatory but indicated that a process-based import condition could be consistent with the GATT if applied in a flexible, cooperative, and non-arbitrary manner.⁷⁷

⁷⁰ GATT Contracting Parties, Report of the Working Party on Border Tax Adjustments, B.I.S.D. 18S/97 (adopted Dec. 02, 1970); Appellate Body Report, *Japan — Taxes on Alcoholic Beverages*, WTO Doc. WT/DS8/AB/R, WT/DS10/AB/R, and WT/DS11/AB/R (adopted Nov. 1, 1996) [hereinafter *Japan — Alcoholic Beverages II*].

⁷¹ *EC — Asbestos*, *supra* note 40.

⁷² *Id.*

⁷³ *US — Tuna II (Mexico)*, *supra* note 41; *US — Shrimp*, *supra* note 12.

⁷⁴ *US — Tuna II (Mexico)*, *supra* note 41.

⁷⁵ *Id.*

⁷⁶ *US — Shrimp*, *supra* note 12.

⁷⁷ *Id.*

The line of cases on likeness and PPMs, therefore, signals a cautious openness to process-based environmental distinctions, yet leaves key questions unresolved. WTO members that seek to differentiate between high-carbon and low-carbon steel, or between deforestation-linked and deforestation-free soy, still face uncertainty about how far PPM differences alone can justify distinct treatment. In that grey zone, WTO adjudicators effectively serve as gatekeepers for the integration of life cycle and process criteria into trade measures.

E. Science, risk and precaution under the Agreement on the Application of Sanitary and Phytosanitary Measures

Science-based disciplines in the SPS Agreement impose a distinct set of constraints on environment-related measures that fall within its scope.⁷⁸ Article 2.2 requires that SPS measures be applied only to the extent necessary to protect life or health, be based on scientific principles, and not be maintained without sufficient scientific evidence, while Article 5.1 of the SPS Agreement requires a risk assessment that is appropriate to the circumstances.⁷⁹ Article 5.5 seeks consistency in levels of protection, and Article 5.7 allows provisional measures where relevant evidence is insufficient, subject to review and efforts to obtain additional information.⁸⁰

In *EC — Hormones*, the AB accepted that WTO members may choose their own level of protection, including a high level, but found that the European Communities had not based its ban on certain growth hormones on an adequate risk assessment as required by Article 5.1.⁸¹ In *Australia — Salmon*, the AB clarified that a risk assessment under Article 5.1 of the SPS Agreement must evaluate the likelihood of entry, establishment, or spread of a pest or disease, as well as the associated potential biological and economic consequences, and must be based on sufficient scientific evidence, rather than mere theoretical possibility.⁸² In *Japan — Agricultural Products II*, the AB described Article 5.7 as a “qualified exemption” from the general obligation not to maintain SPS measures without sufficient scientific evidence.⁸³ The AB has referred to the precautionary principle, including as reflected in the Rio Declaration, but has declined to treat that principle as an independent rule that

⁷⁸ SPS Agreement, *supra* note 44.

⁷⁹ SPS Agreement, *supra* note 44, arts. 2.2, 5.1.

⁸⁰ SPS Agreement, *supra* note 44, arts. 5.5, 5.7.

⁸¹ Appellate Body Report, *European Communities — Measures Concerning Meat and Meat Products (Hormones)*, WTO Doc. WT/DS26/AB/R and WT/DS48/AB/R (adopted Feb. 13, 1998) [hereinafter *EC — Hormones*].

⁸² Appellate Body Report, *Australia — Measures Affecting Importation of Salmon*, WTO Doc. WT/DS18/AB/R (adopted Nov. 06, 1998) [hereinafter *Australia — Salmon*].

⁸³ Appellate Body Report, *Japan — Measures Affecting Agricultural Products*, WTO Doc. WT/DS76/AB/R (adopted Mar. 19, 1999) [hereinafter *Japan — Agricultural Products II*].

overrides the specific terms of the SPS Agreement.⁸⁴ Precaution instead informs the interpretation of provisions such as Articles 5.1 and 5.7 of the SPS Agreement, without displacing the core requirement of a structured risk assessment and ongoing review.

SPS jurisprudence therefore keeps some space for precautionary environmental and health measures, especially through Article 5.7 of the SPA Agreement, but embeds that space within a framework that prioritises demonstrable risk and scientific support. The case law reduces opportunities for disguised protectionism and promotes transparency in regulatory choices. The requirement of risk assessment, regulatory coherence, and ongoing review imposes significant procedural and epistemic costs on the adoption of precautionary measures, especially for WTO members lacking robust scientific and administrative infrastructures. Consequently, the SPS framework systematically favours trade predictability and scientifically grounded regulation, constraining the scope for expansive precautionary responses to environmental uncertainty.

V. INFLUENCE ON INTERNATIONAL ENVIRONMENTAL LAW AND ASSESSMENT OF JUDICIAL IMPACT

A. Domestic implementation and anticipatory regulatory design

Jurisprudence under the GATT, SPS, and TBT Agreements operates not merely as interpretative guidance but as a regulatory signal. WTO members respond to adverse findings by restructuring domestic regimes and internalising WTO legality in the design of future environmental measures. In this manner, Panels and the AB exert *de facto* normative authority over the trade–environment interface, despite lacking competence to formally revise treaty provisions.⁸⁵

United States — Gasoline offers an early illustration. After the AB rejected the discriminatory baseline system for reformulated gasoline, the United States amended its Clean Air Act regulations to equalise the treatment of domestic and imported fuels.⁸⁶ The core environmental objective remained unchanged. The legal change lay in the structure of baselines and the removal of origin-based distinctions. The decision thereby nudged the United States towards an environmental measure that

⁸⁴ *EC — Hormones*, *supra* note 81; Rio Declaration on Environment and Development, principle 15, U.N. Doc. A/CONF.151/26 (Vol. I) (June 14, 1992).

⁸⁵ SIMON LESTER ET AL., *WORLD TRADE LAW: TEXT, MATERIALS AND COMMENTARY* chapters 9 & 13 (3rd ed. 2018) [hereinafter Lester et al.].

⁸⁶ *US — Gasoline*, *supra* note 42.

still restricted trade but did so through origin-neutral, administrable criteria consistent with Article XX and the chapeau.⁸⁷

United States — Shrimp confirms this implementation to be dynamic and extends it into the multilateral sphere. The AB accepted sea turtle protection as falling within Article XX(g), but condemned the unilateral and rigid application of the United States import ban, including the absence of genuine negotiations with affected exporting countries and the inflexibility of certification procedures.⁸⁸ In response, the United States revised its guidelines, entered into regional agreements on turtle excluder devices, and broadened the scope for equivalence and cooperation.⁸⁹ The subsequent Article 21.5 proceedings noted these efforts and found the reformed measure consistent with WTO obligations.⁹⁰ The case thus demonstrates how judicial insistence on non-discrimination and due process can channel environmental protection into more cooperative, less arbitrary forms, rather than displacing it.

The European Union's implementation of *EC — Seal Products* reflects similar dynamics in a different substantive setting. The AB upheld the EU's objective of addressing public moral concerns about seal welfare under GATT Article XX(a), but found that the operation of the "indigenous communities" and "marine resource management" exceptions violated MFN and National Treatment obligations and failed the chapeau because they favoured certain producers *de facto*.⁹¹ The European Union subsequently amended Regulation (EC) No 1007/2009 in 2015, removed the commercial hunting exception, and narrowed the regime to indigenous and limited other hunts, explicitly in light of the WTO rulings.⁹² The measure became more internally coherent, less trade-distorting, and more tightly focused on the moral concern the European Union had invoked. Judicial review thus preserved the core ethical choice while pressing for a more even-handed design.

Current climate-related instruments show anticipatory reliance on this jurisprudence. The EU Carbon Border Adjustment Mechanism (CBAM) adopts product- and installation-specific carbon intensity benchmarks, applies the same carbon price to

⁸⁷ *Id.*

⁸⁸ *US — Shrimp*, *supra* note 12.

⁸⁹ *Id.*; Panel Report, *United States — Import Prohibition of Certain Shrimp and Shrimp Products—Recourse to Article 21.5 of the DSU by Malaysia*, WTO Doc. WT/DS58/RW (adopted Nov. 21, 2001) [hereinafter *US — Shrimp (Article 21.5—Malaysia)*].

⁹⁰ *Id.*

⁹¹ *EC — Seal Products*, *supra* note 17.

⁹² Council Regulation 2015/1775 of Oct. 6, 2015 amending Regulation (EC) No 1007/2009 on trade in seal products and repealing Commission Regulation (EU) No 737/2010, 2015 O.J. (L 262) 1, 2; Trade in Seal Products, EU, https://environment.ec.europa.eu/topics/nature-and-biodiversity/trade-seal-products_en.

domestic and imported products, and phases in the instrument with extensive transparency and review.⁹³ Academic and policy analyses explicitly interpret these design choices through the lens of GATT Articles I and III, the Article XX exceptions, and TBT-style “no more trade-restrictive than necessary” reasoning.⁹⁴ The CBAM seeks to avoid the overt origin-based distinctions and inflexible conditionality condemned in *US — Shrimp* and *EC — Seal Products*, and to present itself as an instrument that internalises a climate externality, rather than protecting European producers.⁹⁵

A similar dynamic appears in ongoing and anticipated disputes about deforestation-related measures and biofuels. The EU Renewable Energy Directive (RED II) and the new Deforestation-Free Products Regulation build on process-based criteria (such as indirect land-use change and forest-risk commodities) that mirror debates on likeness and PPMs discussed in *Asbestos*, *US — Tuna II (Mexico)* and other cases.⁹⁶ Drafting history and legal commentary show that the drafters consciously seek to minimise unjustifiable discrimination between palm oil and other vegetable oils, and to frame the measures as origin-neutral responses to climate and biodiversity risks.⁹⁷ Whether Panels will accept these claims remains uncertain. What matters for present purposes is that WTO case law has become a reference point and constraint in *ex ante* environmental regulatory design.

Taken together, these examples support the claim that WTO judicial bodies significantly shape the form of environmental regulation even when they do not dictate the existence of environmental objectives. WTO members rarely abandon environmental goals after adverse rulings. Instead, they re-engineer instruments to align with the templates of necessity, even-handedness, and material contribution that the previous Part identified.⁹⁸ This indirect influence over design feeds back into

⁹³ Council Regulation 2023/956 of May 10, 2023 Establishing a Carbon Border Adjustment Mechanism, 2023 O.J. (L 130) 52.

⁹⁴ R. Leal-Arcas & Manuliza Faktaufon, *EU Trade Policy and Climate Change: The case for a Carbon Border Adjustment Mechanism*, in OXFORD ENCYCLOPEDIA OF EU LAW 1, 1–9 (2025); R. Leal-Arcas et al., *A Legal Exploration of the European Union’s Carbon Border Adjustment Mechanism*, 31(4) EUR. ENERGY & ENV’T. L. REV. 223 (2022).

⁹⁵ EUROPEAN PARLIAMENT, *Trade Related Aspects of a Carbon Border Adjustment Mechanism: A Legal Assessment* (2020), https://www.europarl.europa.eu/cmsdata/210514/EXPO_BRI%282020%29603502_EN.pdf.

⁹⁶ *EC — Asbestos*, *supra* note 40; *US — Tuna II (Mexico)*, *supra* note 41.

⁹⁷ For discussion, see generally literature on RED II and the EU Deforestation Regulation in light of WTO law. See, e.g., Stefan Mayr et al., *Palm Oil, the RED II and WTO Law: EU Sustainable Biofuel Policy Tangled Up in Green?*, 30(2) REV. EUR. COMP. & INT’L ENV’T L. 238 (2021).

⁹⁸ Lester et al., *supra* note 85, chapter 3.

domestic administrative practice and legislative drafting, thereby, affecting the trade–environment balance well beyond individual disputes.

B. Interaction with multilateral environmental agreements and the climate regime

WTO adjudicators exert influence over the trade–environment interface not only through internal doctrinal development, but also through their engagement with parallel international norms, particularly MEAs and climate instruments. Placed within a pluralistic regime complex, rather than occupying a hierarchical apex, they nonetheless contribute to the normative ordering of regimes by signalling how trade obligations are to be reconciled with environmental commitments.

In *US — Shrimp*, the AB famously drew on a web of international instruments, including CITES and regional sea turtle agreements, to support the view that sea turtle protection reflected “a widely shared” environmental concern.⁹⁹ The report referred to the preambular reference to sustainable development in the WTO Agreement and invoked Article 31(3)(c) VCLT to justify considering relevant rules of international law.¹⁰⁰ Similar moves appear in cases like *EC — Hormones*, where Codex Alimentarius standards serve as a benchmark for SPS consistency, and *EC — Asbestos*, where World Health Organization and International Labor Organization materials inform the assessment of health risks.¹⁰¹ These decisions show that WTO law does not operate in clinical isolation. Judicial bodies treat external environmental norms as interpretative context that can broaden the understanding of “relating to” conservation, “necessary” measures, or legitimate regulatory objectives.

At the same time, WTO Panels and the AB have resisted arguments that MEA obligations automatically trump or reconfigure WTO commitments. Jurisprudence consistently frames external instruments as evidence of legitimacy or as part of the factual and normative background, rather than as hierarchically superior law.¹⁰² WTO adjudicators have not read “incompatibility” or “subordination” clauses into the treaties. The message for WTO members is clear: they must design environmental measures in ways that simultaneously respect WTO commitments and implement MEA obligations. Conflicts must be managed through interpretation and design, not by assuming a general environmental carve-out.

⁹⁹ *US — Shrimp*, *supra* note 12.

¹⁰⁰ *Id.*; Marrakesh Agreement Establishing the World Trade Organization, Preamble, Apr. 15, 1994, 1867 U.N.T.S. 154 [hereinafter Marrakesh Agreement]; VCLT, *supra* note 11, art. 31(3)(c).

¹⁰¹ *EC — Hormones*, *supra* note 81; *EC — Asbestos*, *supra* note 40.

¹⁰² JOOST PAUWELYN, CONFLICT OF NORMS IN PUBLIC INTERNATIONAL LAW: HOW WTO LAW RELATES TO OTHER RULES OF INTERNATIONAL LAW (2003).

This position affects the evolution of MEAs themselves. Negotiators of the Paris Climate Agreement deliberately avoided detailed trade measures and adopted a bottom-up architecture of nationally determined contributions that leaves room for countries to choose their own climate instruments, including those subject to WTO scrutiny.¹⁰³ Climate-club proposals and sectoral agreements, such as those on environmental goods or steel decarbonisation, often incorporate trade law language on non-discrimination and transparency at the drafting stage to reduce the risk of subsequent WTO challenges.¹⁰⁴ In this way, WTO jurisprudence constrains and channels environmental norm-making elsewhere, rather than leaving it untouched.

From another angle, cautious engagement with MEAs also limits the extent of judicial influence. WTO bodies have rarely confronted head-on cases where a WTO member invoked specific MEA obligations as a defence for otherwise WTO-inconsistent measures. The absence of a rich line of “MEA-based” defences means that Panels have not yet had the opportunity to articulate a robust doctrine of deference to environmental treaty regimes.¹⁰⁵ The net effect is a form of soft integration: environmental norms and sustainable development language influence the tone and direction of interpretation, but WTO law retains its identity as a trade-centred regime, with only limited openness to external rebalancing.

C. Regulatory chill, Policy space, and Power asymmetries

Debates over regulatory chill highlight another dimension of judicial influence. Regulatory chill describes a situation in which governments hold back from adopting or tightening environmental measures because they fear successful challenges under

¹⁰³ Paris Agreement, opened for signature Apr. 22, 2016, U.N. Doc. FCCC/CP/2015/L.9/Rev.1, 55 I.L.M. 740 (2016) [hereinafter Paris Agreement]; See Rafael Leal-Arcas et al., *Effectiveness of the UN Framework Convention on Climate Change and the Paris Agreement*, 41(1) CONN. J. INT’L L. (forthcoming 2026); R. Leal-Arcas & A. Morelli, *The Resilience of the Paris Agreement: Negotiating and Implementing the Climate Regime*, 31(1) GEO. ENV’T. L. REV. 1 (2018).

¹⁰⁴ David G. Tarr, *A WTO-Compatible Climate Club that Solves the Free-Rider Problem in Global Climate Policy* (Robert Schuman Ctr. Advanced Stud., Research Paper No. 2024/29, 2025); see also R. LEAL-ARCAS, CLIMATE CLUBS FOR A SUSTAINABLE FUTURE: THE ROLE OF INTERNATIONAL TRADE AND INVESTMENT LAW (2021); Dyuti Pandya & R. Leal-Arcas, *The Creation of a Climate Club for a Sustainable Economic Future: The Role of International Economic Law Amidst Geopolitical Confrontation*, 52(1) GA. J. INT’L & COMP. L. 1 (2024); R. Leal-Arcas et al., *The World Trade Organization and Carbon Market Clubs*, 52(4) GEO. J. INT’L L. 895 (2021); R. Leal-Arcas & A. Filis, *International Cooperation on Climate Change Mitigation: The Role of Climate Clubs*, 30(5) EUR. ENERGY & ENV’T. L. REV. 195 (2021); R. Leal-Arcas, *Climate Clubs and International Trade Across the European and International Landscape*, 29(3) EUR. ENERGY & ENV’T. L. REV. 72 (2020).

¹⁰⁵ Lester et al., *supra* note 85, chapter 3.

trade or investment agreements. In the WTO context, critics argue that strict readings of SPS and TBT disciplines, combined with the costs of defending cases and implementing adverse rulings, may deter especially smaller or developing countries from pursuing precautionary regulation.¹⁰⁶

Empirical work paints a more nuanced picture. The WTO's own World Trade Report has noted concerns about "regulatory chill" or a "race to the bottom" in environmental standards, but finds limited evidence of actual deterioration in environmental indicators attributable to trade liberalisation.¹⁰⁷ In many high-profile disputes, respondents have maintained or even strengthened environmental measures after losing, as the Gasoline, Shrimp, and Seal Products examples show.¹⁰⁸ Scholarship on SPS and TBT practice suggests that WTO members continue to notify and implement a large number of stringent regulations, even in sensitive sectors such as food safety and animal health.¹⁰⁹ These observations indicate that formal judicial scrutiny has not produced a generalised downward spiral.

Nevertheless, the risk of challenge shapes the type of measures that governments adopt. SPS jurisprudence on risk assessment and "sufficient scientific evidence" pushes regulators towards science-heavy, expert-driven processes that can be costly to maintain.¹¹⁰ TBT case law on "less favourable treatment" and "no more trade-restrictive than necessary" encourages origin-neutral, standards-based approaches, rather than targeted restrictions on particular foreign products, even where environmental externalities in fact correlate with specific production patterns.¹¹¹ For high-capacity regulators, these requirements may be manageable and even useful in disciplining domestic protectionist pressures. For low-capacity governments, the technical and evidentiary burdens can become a *de facto* barrier to adopting ambitious precautionary measures.

Power asymmetries in the system amplify these effects. Developed WTO members bring and defend the vast majority of TBT and SPS disputes and possess the resources to commission complex risk assessments or cost-benefit studies.

¹⁰⁶ WORLD TRADE ORGANIZATION, WORLD TRADE REPORT 2005: EXPLORING THE LINKS BETWEEN TRADE, STANDARDS AND THE WTO (2005), https://www.wto.org/english/res_e/booksp_e/anrep_e/world_trade_report05_e.pdf [hereinafter WTO World Trade Report 2005].

¹⁰⁷ *Id.*

¹⁰⁸ *US — Gasoline*, *supra* note 42; *US — Shrimp*, *supra* note 12; *EC — Seal Products*, *supra* note 17.

¹⁰⁹ Lester et al., *supra* note 85, chapter 3.

¹¹⁰ *EC — Hormones*, *supra* note 81; Panel Report, *Australia — Measures Affecting the Importation of Salmon*, WTO Doc. WT/DS18/R (adopted Nov. 6, 1998); *Australia — Salmon*, *supra* note 82.

¹¹¹ *US — Tuna II (Mexico)*, *supra* note 41; *US — Clove Cigarettes*, *supra* note 61.

Commodity-exporting developing countries often confront environmental measures imposed by major importing markets, such as palm-oil-related criteria in EU biofuel policy or deforestation regulations that affect tropical timber and agricultural exports. Even if the legal doctrines are formally symmetrical, the capacity to use them strategically is not. Concerns about losing market access can combine with the uncertainty generated by open-textured concepts like “necessity” and “material contribution” to produce a chilling effect at the margins, particularly outside high-profile cases.

The regulatory chill debate therefore reinforces the central argument of this paper. WTO judicial bodies exercise substantial influence over the conditions under which environmental regulation can proceed. They do so through demanding evidentiary standards, structured balancing tests, and a firm insistence on non-discrimination, as the previous Part showed. Yet the impact is differentiated: it may discipline disguised protectionism in some contexts, while constraining the policy space of weaker states in others. The balance between trade and environmental protection that emerges is thus not normatively neutral, but it reflects existing distributions of power and expertise.

D. Dimensions and limits of judicial influence: an assessment

Part III traced how Panels and the AB crafted cross-cutting doctrines (necessity, even-handedness, likeness, material contribution, and science-based risk assessment) that determine when environmental measures survive scrutiny. The discussion in this Part shows how those doctrines ripple outward through domestic implementation, MEA design, and regulatory strategy. Together, they allow a more precise answer to the question “to what extent” WTO judicial bodies shape the trade–environment balance in international law.

First, their influence on doctrine within WTO law is profound. The meaning of GATT Article XX, the scope of SPS disciplines, and the operation of TBT Articles 2.1 and 2.2 today are largely products of case law, rather than drafting history alone. Judicial reasoning has normalised environmental and health protection as legitimate objectives, recognised animal welfare and public morals as valid bases for regulation, and adopted a structured proportionality-type analysis that weighs contribution, restrictiveness, and reasonably available alternatives. This jurisprudence has made it far easier for states to defend well-designed environmental measures than under the pre-WTO GATT, while still policing discrimination and protectionist abuse.

Second, their institutional influence remains significant despite the AB crisis. Panel reports, especially in environmental cases, are detailed, reasoned, and widely treated as persuasive precedent by WTO members, scholars, and other tribunals. The creation of the MPIA among a group of WTO members preserves appellate-style

review in a subset of disputes and helps maintain continuity in legal reasoning.¹¹² Even where parties “appeal into the void,” panel findings shape expectations about what will count as WTO-consistent regulation, and thus feed into *ex ante* regulatory design.¹¹³

Third, there are clear limits to this influence. Treaty texts continue to constrain interpretative choices. SPS provisions on scientific evidence and appropriate levels of protection leave less room for precautionary approaches than many environmental lawyers would prefer. The cautious stance on export restrictions in cases such as *China — Rare Earths* signals reluctance to accept resource-conservation rationales that intersect with industrial policy.¹¹⁴ Above all, the political backlash culminating in the paralysis of the AB shows that WTO members can and do react when they perceive judicial bodies as overstepping, whether in trade–environment disputes or in other areas. The authority of WTO adjudicators ultimately rests on acceptance by a member-driven organisation that can rewrite rules, refuse to fill vacancies, or construct alternative forums.

Finally, the influence of WTO judicial bodies on international environmental law remains indirect and bounded. Their decisions shape how states implement MEA commitments and design climate and biodiversity policies, and they contribute to the broader understanding of sustainable development and environmental legitimacy in international law. They also introduce trade-centred concepts such as non-discrimination, transparency, and proportionality into the design of environmental instruments and climate-club proposals. Yet they do not control the content of MEAs, cannot force states to adopt specific environmental standards, and operate within a regime whose founding objective remains trade liberalisation.

Overall, WTO Panels and the AB exercise substantial but limited influence over the balance between trade liberalisation and environmental protection. They decisively structure the legal space within which WTO members design and defend environmental measures under WTO law and thereby shaping domestic and international regulatory practice. At the same time, textual constraints, power asymmetries, and political backlash confine their authority. Rather than displacing environmental treaty-making or domestic policymaking, WTO judicial bodies function as powerful but bounded guardians of a trade-centred framework into which environmental protection must be fitted.

¹¹² WORLD TRADE ORGANIZATION, *Alternative Dispute Resolution Procedures (MPIA)*, WTO, https://www.wto.org/english/tratop_e/dispu_e/mpia_e.htm.

¹¹³ Maria Angelica Suarez, *The Appellate Body Impasse: How to Make the WTO Great Again?*, 56(2) N.Y.U. J. INT'L L. & POL. 965 (2024).

¹¹⁴ *China — Rare Earths*, *supra* note 42.

VI. CONCLUSION

This paper has examined the extent to which WTO judicial bodies shape the balance between trade liberalisation and environmental protection in international law. It has argued that the apparent balance between trade liberalisation and environmental protection in WTO law is not a doctrinal equilibrium but a product of adjudicative strategies that selectively expand and constrain regulatory space. Moreover, it has argued that Panels and the AB exert significant but bounded influence—they do not rewrite treaties or dictate environmental ambition; yet they decisively structure the legal and practical conditions under which environmental measures are designed, defended, and implemented within a trade-centred regime.

The analysis has shown, first, that the most direct channel of influence is doctrinal. Through the interpretation of GATT Article XX, the SPS Agreement, and the TBT Agreement, WTO adjudicators have operationalised a set of recurring disciplines (i.e., necessity reasoning, even-handedness, science-based justification, and structured assessments of contribution and alternatives) that effectively function as a governance framework for environmental regulation affecting trade. This jurisprudence has both enabled and constrained environmental policy—it has legitimised environmental objectives and clarified pathways for justification, while also imposing evidentiary and design requirements that can narrow precautionary approaches and heighten the legal risk of targeted restrictions. WTO adjudicators should adopt a more deferential standard under Article XX by relaxing the necessity test where environmental measures address transboundary harm.

Second, the paper has emphasised that judicial influence is also institutional and anticipatory. Even amid the current AB crisis, legal reasoning developed through WTO disputes continues to shape state behaviour, not only through formal compliance, but through *ex ante* regulatory planning. The persistence of panel practice, the reputational and market-access stakes of adverse findings, and interim mechanisms such as the MPIA together sustain a system in which legal expectations are formed and internalised. In this sense, the WTO's judicial output remains influential even when formal appellate review is impaired because it structures what WTO members believe will count as defensible regulation.

Third, the paper has highlighted that the WTO's trade–environment balance is not produced in clinical isolation. The effects of judicial doctrine are filtered through capacity and power asymmetries. Legal standards that appear symmetrical in abstract can generate unequal burdens in practice, particularly where sophisticated risk assessments, technical evidence, and litigation resources determine whether environmental measures survive scrutiny. The regulatory chill debate illustrates this dynamic, i.e., the strongest impact is not necessarily a generalised lowering of standards, but a differentiated shaping of regulatory choices, steering governments

toward origin-neutral, and technocratic designs, while potentially discouraging more ambitious or precautionary measures where institutional capacity is limited.

At the same time, the limits of judicial influence are real and consequential. Treaty text continues to set boundaries; the member-driven nature of the WTO constrains interpretative authority; and the political backlash reflected in the AB paralysis demonstrates that adjudication depends on institutional consent. Moreover, WTO judicial bodies influence international environmental law indirectly: they can encourage certain regulatory forms and embed trade law disciplines into environmental governance, but they do not control the content of MEAs, nor do they supply a comprehensive normative hierarchy capable of resolving all conflicts between trade and environmental commitments.

Taken together, these findings support a balanced conclusion: WTO adjudicators are neither neutral specialists nor autonomous environmental lawmakers. They function instead as powerful but bounded guardians of a trade-centred legal order, one that increasingly accommodates environmental objectives but does so through conditional forms of acceptance, demanding justification, disciplined design, and non-discriminatory application. The resulting balance is therefore best understood not as a simple choice between trade and environment, but as a governance settlement where environmental protection is permitted and often endorsed; but it must be fitted into a framework that privileges predictability, market access, and constraint on disguised protectionism.

VII. A RESEARCH AGENDA FOR INTERNATIONAL TRADE GOVERNANCE

In light of the systemic disconnect between trade liberalisation and environmental protection in international law revealed by our analysis, we propose a research agenda for a future design of international trade agreements.

A. *The Context*

Sustainability is a necessity for our world, as it encompasses environmental protection, economic well-being and social equity. It has an inter-generational dimension because using natural resources sustainably today will help future generations.¹¹⁵ However, our current use of natural resources is damaging our

¹¹⁵ In the case of climate change and energy, the indicators of sustainability are greenhouse gas emissions, primary energy consumption, and the share of renewable energy in gross final energy consumption. See, J. Stiglitz et al., *Report by the Commission on the Measurement of Economic Performance and Social Progress* (2008), <https://ec.europa.eu/eurostat/documents/8131721/8131772/Stiglitz-Sen-Fitoussi-Commission-report.pdf> [hereinafter Stiglitz et al., Measurement Report].

environment and triggering climate change. Given the urgency¹¹⁶ of the issue as noted in the increasing number of floods and other natural catastrophes in recent times, the United Nations designed the Sustainable Development Goals (SDGs)—a set of 17 goals that provide a “shared blueprint for peace and prosperity for people and the planet, now and into the future.”¹¹⁷ However, there is little explicit language in the SDGs’ targets and indicators that addresses the crucial role played by global trade in achieving them.

We recognise the untapped potential of international trade as a vehicle for change and realise there is a crucial need to develop the discipline of international trade law to understand and accommodate this role for trade. With 166 countries engaging in the multilateral trading system, and around USD 24 trillion moved in merchandise trade alone in 2024,¹¹⁸ trade holds the unique position of uniting the world, transcending borders, mobilising trillions of dollars, and driving innovation and competition. Moreover, at the multilateral level, trade has a unique dispute settlement mechanism that, in principle at least, aims to give everyone, from least developed countries to developed countries, an equal voice.

One can focus on two key environmental issues and their relationship with trade which are mainly, ‘sustainable energy’ and ‘climate change’. Sustainable energy is crucial in a world where around 666 million people still had no access to electricity as of 2023.¹¹⁹ Energy security, or access to energy at an affordable price, is one of the main problems humanity faces.¹²⁰ Without access to energy, people and countries cannot develop their potential.¹²¹

¹¹⁶ Jesse D. Jenkins (@JesseJenkins), TWITTER (Nov. 13, 2018), <https://twitter.com/JesseJenkins/status/1062448890543267841>.

¹¹⁷ UNITED NATIONS, Sustainable Development Goals, <https://sustainabledevelopment.un.org/sdgs>.

¹¹⁸ *World Merchandise Trade 2024*, TBS News (2024), <https://www.tbsnews.net/infograph/numbers/world-merchandise-trade-2024-1280906>.

¹¹⁹ World Bank, *Energy Access Has Improved, Yet International Financial Support Still Needed to Boost Progress and Address Disparities*, (June 25, 2025), <https://www.worldbank.org/en/news/press-release/2025/06/25/energy-access-has-improved-yet-international-financial-support-still-needed-to-boost-progress-and-address-disparities>.

¹²⁰ RAFAEL LEAL-ARCAS, *THE EUROPEAN ENERGY UNION: THE QUEST FOR SECURE, AFFORDABLE AND SUSTAINABLE ENERGY* (2016).

¹²¹ In the view of the European Commission, there are three main goals in the clean energy transition: putting energy efficiency first, achieving global leadership in renewable energies, and providing a fair deal for consumers. See, European Commission, *Commission Proposes New Rules for Consumer-Centred Clean Energy Transition*, (Nov. 30, 2016), <https://ec.europa.eu/energy/en/news/commission-proposes-new-rules-consumer-centred-clean-energy-transition>.

Moreover, climate change is driving a shift from fossil fuels towards clean and renewable energy,¹²² i.e., energy from sustainable sources, as opposed to conventional sources such as oil, natural gas,¹²³ or coal.¹²⁴ As the price of oil goes up, there will be a greater incentive for countries to invest in renewables to eventually obtain a cheaper, cleaner, and more secure supply of energy. In this context, two energy developments are happening that explain geopolitical shifts in energy security: (i) a revolution in unconventional energy,¹²⁵ and (ii) a shift to a more environmentally sustainable global energy mix.¹²⁶ As a result, we can expect that the energy transition will have major geopolitical consequences.¹²⁷

Equally, it is very likely that, in the future, there will be less energy trade in commodities due to a more environmentally sustainable global energy mix. Instead, it is very probable that we will see more renewable energy trade via electricity thanks to technology. We will also see more decentralised approaches to energy supply, including the deployment of smart grids that allow for the integration of renewables and a more flexible system that accommodates fluctuations in supply and demand. All these changes open up significant opportunities and challenges for international trade.

The idea, therefore, is to promote a holistic view of international trade law that recognises trade as a vehicle for multiple global goods and to forge new territory in the discipline of international trade law, addressing the linkages between trade and

¹²² See for instance the growing pressure Cambridge University faced in October 2017 to abandon its investments in fossil fuels because they are incompatible with the Paris Climate Agreement. See, A. Mooney, *Pressure Grows on £6.3bn Cambridge University Fund to Drop Fossil Fuels*, Fin. Times (Oct. 08, 2017), <https://www.ft.com/content/8eeeca3ec-aaab-11e7-93c5-648314d2c72c?syn-25a6b1a6=1>.

¹²³ Nevertheless, one should acknowledge that the abundance of natural gas is transforming the natural-gas market. Prior to 2000, almost all-natural gas was either consumed where it was produced or was traded to other countries via pipelines. Growth in supplies and in liquefied natural gas (LNG) is driving growth in gas trade in the world. An increasing number of countries has been importing LNG since 2000, resulting in more fluid, more integrated markets. See, Megan O'Sullivan, Lecture at Harvard University (Oct. 3, 2018).

¹²⁴ LEONARDO MASSAI, *EUROPEAN CLIMATE AND CLEAN ENERGY LAW AND POLICY* (2011).

¹²⁵ See, R. Leal-Arcas, *Unconventional Sources of Fossil Fuel in the European Union and China: Perspectives on Trade, Climate Change and Energy Security*, in *CLIMATE AND ENERGY PROTECTION IN THE EU AND CHINA* 129 (P. Hefele et al. eds., 2018).

¹²⁶ M. O'Sullivan et al., *The Geopolitics of Renewable Energy* (Harvard Kennedy Sch. Faculty Rsch. Working Paper 17-027, 2017), <https://www.hks.harvard.edu/publications/geopolitics-renewable-energy> (there are several mechanisms where renewables could shape geopolitics: critical materials supply chains, technology and finance, new resource curse, electric grids, reduced oil and gas demand, avoided climate change, and sustainable access to energy.)

¹²⁷ *Id.*

sustainability. The statement above raises the following question: How can international trade and decarbonisation work together harmoniously without impeding each other in the context of an emerging decentralised energy system? We argue that the trading system can be part of the solution, not the problem, to environmental protection. We are not capitalising on the international trading system to achieve two crucial 21st century goals—‘sustainable energy’ and ‘climate change mitigation’.

B. Trade agreements as a vehicle for climate action and sustainable energy

From energy transit to technology transfer, to investment protection, renewable energy, and trade, the trade agreements present interplays across various fields. New trade agreements have the potential to better address common concerns. Improvements can be made to the trading system to ensure sustainable energy and more efficient energy markets. There are still very few trade agreements with sustainable development chapters. We argue that trade agreements can be a vehicle to address global common concerns.

1. How can we use the trading system to achieve sustainability?

Trade agreements can help mitigate climate change since, in the past, they have been a very powerful instrument for change. We could use trade agreements as a novel tool to solve one of the most important challenges of today, namely climate change, given that they are enforceable, unlike traditional environmental agreements. An example of success thanks to trade is the role of trade in economic growth and prosperity, which is well known. In fact, a sharp rise in developing-country participation in trade has coincided with an equally striking decline in extreme poverty worldwide.¹²⁸ Developing countries make up 48 per cent of world trade, up from 33 per cent in 2000,¹²⁹ and since 1990, the number of people living in extreme poverty has declined by more than half—from around 2.3 billion to roughly 800 million by 2025.¹³⁰ Trade has helped increase the number and quality of jobs in developing countries, stimulated economic growth, and increased productivity.¹³¹

¹²⁸ WORLD BANK & WORLD TRADE ORGANIZATION, THE ROLE OF TRADE IN ENDING POVERTY (2015), https://www.wto.org/english/res_e/booksp_e/worldbankandwto15_e.pdf [hereinafter Role of Trade in ending Poverty].

¹²⁹ *Id.*

¹³⁰ WORLD BANK, *Poverty Overview*, World Bank, <https://www.worldbank.org/en/topic/poverty/overview>.

¹³¹ Role of Trade in ending Poverty, *supra* note 128.

In terms of the social dimensions of sustainable development, trade has often been a force for good and there is potential to do more. For one thing, the economic benefits of trade can empower people to address social inequities where they live.¹³²

Additionally, trade agreements often include provisions that address social problems. For example, 75 per cent of countries use trade agreements to safeguard human rights.¹³³ In 2013, 58 trade agreements included labour provisions.¹³⁴ Trade also facilitates innovation, allowing the spread of new ideas and technology through trade in goods and services.

Despite these positive social dimensions, when it comes to the environmental dimension of sustainable development, trade is traditionally seen as a harm doer. Trade-driven changes to agriculture have led to deforestation and biodiversity losses.¹³⁵ Images abound of cargo ships polluting the oceans and of factories releasing toxic fumes into the atmosphere. Given this situation, it seems counter-intuitive to assert that trade can be an important vehicle for environmental protection. Yet, this is precisely what we propose.

The idea is to forge a new path within international trade law, linking trade to the achievement of two key global challenges: ‘sustainable energy’—energy that is affordable, secure, and clean and ‘climate change mitigation’ (which depends on achieving sustainable energy). We challenge traditional approaches to trade law and believe one can create a space in the discipline of international trade law for capitalising on trade for goals that transcend solely economic ones. Very little theoretical work exists on renewable energy law and even less on trade in renewables. The question: ‘How can we use the trading system to achieve sustainability?’ addresses an important knowledge gap from an interdisciplinary perspective. It aims to open up new horizons for research in three ways: (i) currently, we do not have a good understanding of the links between trade and renewable energy, of how trade can promote renewable energy and, therefore, help mitigate climate change; (ii)

¹³² Siyi Shen, *Trade and Sustainable Development: Friend or Foe?*, CTR. FOR INT’L ENV’T. L. (FEB. 06, 2018), <https://www.ciel.org/trade-sustainable-development-friends-foes/>.

¹³³ Susan Ariel Aaronson & Jean Pierre Chauffour, *The Wedding of Trade and Human Rights: Marriage of Convenience or Permanent Match?*, WORLD TRADE ORGANIZATION (Feb. 15, 2011), https://www.wto.org/english/res_e/publications_e/wtr11_forum_e/wtr11_15feb11_e.htm.

¹³⁴ INT’L LAB. ORG., SOCIAL DIMENSIONS OF FREE TRADE AGREEMENTS, https://www.ilo.org/sites/default/files/wcmsp5/groups/public/@dgreports/@inst/documents/publication/wcms_228965.pdf.

¹³⁵ INTERGOVERNMENTAL SCIENCE-POLICY PLATFORM ON BIODIVERSITY AND ECOSYSTEM SERVICES (IPBES), GLOBAL ASSESSMENT REPORT ON BIODIVERSITY AND ECOSYSTEM SERVICES (2019) https://files.ipbes.net/ipbes-web-prod-public-files/inline/files/ipbes_global_assessment_report_summary_for_policymakers.pdf.

through the application of our findings to other areas of sustainable development, e.g., trade and gender issues; and (iii) how trade is underutilised to promote issues of global common concern.

2. How can trade law be the enforcer of climate-change obligations?

International trade law may be used to help decarbonise the economy by bundling the fate of free trade agreements (FTAs) and international climate-change obligations, i.e., the breach of international climate-change obligations would give rise to legal consequences under the dispute settlement mechanisms of FTAs. The argument is that trade agreements may be more effective legal instruments than environmental agreements for environmental-protection purposes—a possibility that is both counter-intuitive and surprising. It seems that trade agreements are stricter on environmental protection (see, for instance, the Comprehensive and Progressive Agreement for Trans-Pacific Partnership's (CPTPP) chapter on environment in relation to a low-emissions economy) than climate change agreements such as the Paris Agreement. In other words, trade agreements such as the CPTPP contain more judicialised and sanction-backed environmental obligations than climate agreements like the Paris Agreement, which rely primarily on nationally determined commitments and facilitative compliance mechanisms. That the CPTPP is enforceable on the reduction of greenhouse gas emissions, whereas the Paris Agreement is not, enhances those stricter provisions. If FTAs contain legally binding and enforceable rules on the environment, climate change, and sustainable development, they could help the decarbonisation of the economy, lead to climate change mitigation, and to energy security.

C. Reframing Trade Law: Towards a Theory of the Triple Benefit of Trade

We argue that trade can drive environmental protection by promoting sustainable energy. This hypothesis takes the unconventional view that the trading system goes beyond benefiting the economy and society in that it can also contribute to environmental protection, with a specific focus on decarbonisation. In this sense, we propose a paradigm shift in the theoretical side of trade law to develop a new theory on the 'Triple Benefit of Trade', namely that the trading system may help with the mitigation of climate change, enhancement of energy security, and economic growth. This new theory has the potential of transforming the discipline of international trade law and open up new lines of research. It will push the discipline of international trade law into new territory, allowing for a more holistic understanding of trade as a driver of more than simply economic prosperity. In the 21st century, with 21st century challenges, we need to reconsider our understanding of trade, its impacts, and its potential.

In today's interconnected world, a holistic approach in all fields is necessary. No area of research and no sector can operate in isolation. Understanding how they link and overlap to exploit them for maximum benefit is the key. In the year 2000, the international community devised the Millennium Development Goals (MDGs), aimed at reducing extreme poverty and hunger and addressing other crucial global concerns such as education and gender equality. While revolutionary, and an important step forward, the MDGs did not factor in the key interdependencies amongst the goals and did not look at environmental sustainability, social inclusion, and economic development as interlinked.¹³⁶ This omission is what gave rise to the SDGs, which take a comprehensive and integrated approach in addressing the same issues.

In a similar vein, the traditional view of trade has been limited to the buying and selling of goods and services with a view to achieving economic goals. But, as discussed above, trade plays such a significant role in the global *status quo* that this narrow approach is no longer feasible. It is crucial to advance the discipline of trade law to pave the way for new theories and concepts of trade as a vehicle for social and environmental benefits.

Very little research has been conducted on the impact of Preferential Trade Agreements (PTAs),¹³⁷ in addressing climate change mitigation/environmental protection and energy security.¹³⁸ There is also insufficient research on how the trade and renewable energy regimes can cooperate. No one has conducted the kind of research required to understand the role of trade in sustainability issues. New agreements are starting to include sustainable development chapters,¹³⁹ and various

¹³⁶ See, U.N. DEV. PROGRAMME (UNDP), *Transitioning from the MDGs to the SDGs*, UNDP (2016), <http://www.undp.org/content/undp/en/home/librarypage/sustainable-development-goals/transitioning-from-the-mdgs-to-the-sdgs.html>.

¹³⁷ Not all preferential trade agreements (PTAs) are free trade agreements (FTAs), but every FTA is a PTA, PTAs are the umbrella term.

¹³⁸ Leal-Arcas R and Wilmarth CM, *Strengthening Sustainable Development Through Preferential Trade Agreements*, in ENSURING GOOD GLOBAL GOVERNANCE THROUGH TRADE: EU POLICIES AND APPROACHES 92 (J. Wouters et al. eds., 2015); Robert Falkner & Nico Jaspers, *Environmental Protection, International Trade and the WTO*, in THE ASHGATE RESEARCH COMPANION TO INTERNATIONAL TRADE POLICY 245 (Ken Heydon & Stephen Woolcock eds., 2012); R. Reuveny, *On Free Trade, Climate Change, and the WTO*, 1(1) J. GLOBALIZATION STUD. (2010); Essi Eerola, *International Trade Agreements, Environmental Policy, and Relocation of Production*, 28(4) RES. & ENERGY ECON. 333 (2006); ERIKA VRANES, *TRADE AND THE ENVIRONMENT* (2009); CLIMATE AND TRADE POLICY: BOTTOM-UP APPROACHES TOWARDS GLOBAL AGREEMENT (Carlo Carraro & Christian Egenhofer eds., 2007).

¹³⁹ Steve Charnovitz, *The WTO's Environmental Progress*, in THE FUTURE OF INTERNATIONAL ECONOMIC LAW 249, 249–251 (William J. Davey & John H. Jackson eds., 2008); Robert Falkner & Nico Jaspers, *Environmental Protection, International Trade and the WTO*, in THE ASHGATE RESEARCH COMPANION TO INTERNATIONAL TRADE POLICY 245 (Ken Heydon

think tanks and institutes are starting to discuss this issue.¹⁴⁰ But there is no thorough empirical and theoretical study of what impact such sustainable development chapters are having so far, how they can improve, how the two regimes operate and can align better, and how to capitalise on trade to really push forward the renewable energy agenda.¹⁴¹

& Stephen Woolcock eds., 2012) (also, environmental issues are starting to play a more prominent role in the WTO dispute settlement system.); *See also* US — *Gasoline*, *supra* note 42; US — *Shrimp*, *supra* note 12; EC — *Asbestos*, *supra* note 40.

¹⁴⁰ David Branford, *International Trade Disciplines and Policy Measures to Address Climate Change Mitigation and Adaptation in Agriculture*, in *TACKLING AGRICULTURE IN THE POST-BALI CONTEXT* (Ricardo Meléndez-Ortiz eds., 2014); Aaditya Mattoo & Arvind Subramanian, *Four Changes to Trade Rules to Facilitate Climate Change Action*, VoxEU (May 04, 2013), <https://voxeu.org>; Petros Mavroidis & Jaime de Melo, *Climate Change Policies and the WTO: Greening the GATT, Revisited*, in *TOWARDS A WORKABLE AND EFFECTIVE CLIMATE REGIME* 225, 225–236 (Scott Barrett, Carlo Carraro & Jaime de Melo eds., 2015).

¹⁴¹ This situation raises the question whether climate change demands a normative shift in how we think about the trade regime. *See* H.E. Daly, *Against Free Trade: Neoclassical and Steady-State Perspectives*, 5(3) J. EVOLUTIONARY ECON. 313 (1995); Ben Lilliston, *The Climate Cost of Free Trade: How TPP and Trade Deals Undermine the Paris Climate Agreement*, INST. FOR AGRIC. & TRADE POL'Y (2016); K. Kanemoto et al., *International Trade Undermines National Emission Reduction Targets: New Evidence from Air Pollution*, 24(1) GLOBAL ENV'T. CHANGE 52 (2014).